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NICHOLS NEW GRADED LESSONS IN ARITHMETIC

PART TWO

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NEW GRADED LESSONS
IN
ARITHMETIC

PART II

BY
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PREFACE

THIS book is designed for the use of pupils during the fifth and sixth years of school. The work intended for each year is indicated and will be found to contain *first*, a review of all work up to the present time; *second*, a presentation of new work, and *third*, a general summary at the end.

The book aims to give the pupils slightly more complicated exercises, and those involving somewhat larger numbers than in the preceding book, thus keeping pace with their enlarging powers. The problems have been carefully selected and made as practical as the experiences of the pupils will allow.

A large amount of oral work is given, because of the belief that skill in solving problems orally is the best preparation a pupil can have for the problems that he will meet in life. Pupils should be urged to solve orally as many problems as possible in every lesson.

Since a thorough mastery of any subject comes only from repetition, many review exercises are given so that the pupils may learn to rely upon themselves and to work independently.

The author acknowledges his indebtedness to all who have assisted by suggestions, but especially to Miss Mabel L. Gessner, who planned the lessons devoted to Domestic

Science, to Mr. Claud Russell, Supervising Principal of the Dwight District, New Haven, to Miss Isabella J. Ray, Emerson School, Boston, who read the manuscript and suggested improvements.

WILBUR F. NICHOLS.

NEW HAVEN, January, 1911.

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SECTION I

Lesson 1. *ORAL REVIEW*

1. 6+7+8+3=——.

2. 9+4+5+8=——.

3. Read these 2 examples.

4. Of what is + the sign? Of what is = the sign?

5. What is the result of example 1? Of example 2?

6. The result of an example in addition is called the **sum.**

7. **Addition** is the process of uniting two or more numbers into one number.

8. The numbers to be united are called **addends.**

Add rapidly, giving results only:

9. $\begin{array}{r}75\\ \underline{87}\end{array}$ **10.** $\begin{array}{r}68\\ \underline{79}\end{array}$ **11.** $\begin{array}{r}86\\ \underline{37}\end{array}$ **12.** $\begin{array}{r}95\\ \underline{48}\end{array}$ **13.** $\begin{array}{r}79\\ \underline{84}\end{array}$

Train the pupils to *think* 75 and 7 are 82, 82 and 80 are 162, but to *say* only 75 and 87 are 162.

Add as indicated above:

14. $\begin{array}{r}48\\ \underline{19}\end{array}$ **15.** $\begin{array}{r}66\\ \underline{77}\end{array}$ **16.** $\begin{array}{r}33\\ \underline{87}\end{array}$ **17.** $\begin{array}{r}86\\ \underline{96}\end{array}$ **18.** $\begin{array}{r}84\\ \underline{75}\end{array}$

1. Add: 239; 873; 472; 964; 697.

239
873
472
964
697
25
32
29
3245

The method here indicated of retaining the sum of each column, especially in adding long ledger columns, is advocated by accountants. It enables one to find errors in any column without adding other columns.

Add as indicated above, *checking* the result by adding upwards and downwards:

1. 8277
6949
9788
9686
6798
5848
7984
5878

2. 7281
4969
8799
8698
9769
4858
8979
7857

3. 6987
6668
7875
8997
4885
9796
8689
8799

4. 9752
7831
5527
9886
7734
9958
9475
6279

5. 6677
1196
6336
9474
4893
8986

6. 5966
2787
6896
8567
5674
8963

7. 7238
4497
9864
8937
4774
3683

8. 4922
7857
9637
4762
5446
6697

9. 7533
6387
4491
8746
9384
8434

10. 5644
2674
7473
4758
8229
2294

11. 2674
6445
7966
5863
4349
3849

12. 8758
3357
9185
4613
8496
3492

1. A grain dealer sold wheat as follows: Monday 2176 bu., Tuesday 1085 bu., Wednesday 1694 bu., Thursday 2642 bu., Friday 918 bu., and Saturday 2867 bu. How many bushels did he sell during the week?

2. A merchant began business with goods worth $5680 and a store worth $3462. He gained during the year $1267. What was he then worth?

3. I bought a suit of clothes for $27.50, an overcoat for $18.75, a pair of shoes for $4.75, a hat for $2.65 and a pair of gloves for $1.38. What was the cost of all?

4. A owns 468 acres of land, which is 182 acres less than B owns. How much land has B? How much have A and B together?

5. A owns 316 acres of land, B owns 78 acres more than A. How many acres does B own? C owns as many as A and B together. How many acres does C own?

6. A farmer values his horses at $375, his cows at $415, his sheep at $118, his hogs at $65, and his poultry at $74. What is the value of all?

7. Four men went into business together. A put in $1768, B, $1848, C, $1715 and D, $968. How much did they all put in?

8. A man bought a house for $4200, and paid $185 for repairs, and $216 for painting. For how much must he sell it in order to gain $300?

9. A merchant paid $427 for one lot of goods, $657 for another and $452 for a third. How much did they all cost?

10. Mr. Fraser's house cost for brick $324, for lumber $726, other material $315. He paid to the carpenters $569, to the masons $568 and to the painters $418. What was the entire cost of the house?

11. Find the entire weight of five loads of hay weighing respectively 1986 lb., 2240 lb., 2086 lb., 1789 lb., 2064 lb.

1. 17 − 9 = ——. What is indicated by the sign − ? What is the result?

2. **Subtraction** is the process of taking one number from another or it is the process of finding what part of a given number remains, when a part has been taken away.

3. The **minuend** is the number from which we subtract.

4. The **subtrahend** is the number which is taken away.

5. The result of an example in subtraction is called **difference or remainder.**

6. From 75 take 46. Pupils should think 75 − 6 = 69. 69 − 40 = 29.

Subtract the following orally and rapidly:

7. $\begin{array}{r}72\\ \underline{48}\end{array}$ **8.** $\begin{array}{r}85\\ \underline{36}\end{array}$ **9.** $\begin{array}{r}76\\ \underline{41}\end{array}$ **10.** $\begin{array}{r}80\\ \underline{28}\end{array}$ **11.** $\begin{array}{r}67\\ \underline{19}\end{array}$

12. In examples 7-11, name the subtrahend and minuend and difference.

13. From 100 subtract each of the following:

49, 25, 67, 32, 56, 37, 43, 83, 14, 59, 74, 63, 85, 46.

14. The subtrahend is 17, the minuend 35. What is the difference?

15. 36¢ have been taken out of 75 cents. What is the remainder?

16. The remainder is 23¢, the minuend is 50¢. What is the subtrahend?

17. The difference added to the subtrahend will give the ——.

18. Which is the larger number, the minuend or the subtrahend?

19. *a.* 23 − 9 = ——. *b.* 23 − 14 = ——. c. 14 + 9 = ——.

Give the differences rapidly:

20. $\begin{array}{r}46\\ \underline{22}\end{array}$ **21.** $\begin{array}{r}46\\ \underline{28}\end{array}$ **22.** $\begin{array}{r}32\\ \underline{19}\end{array}$ **23.** $\begin{array}{r}45\\ \underline{26}\end{array}$ **24.** $\begin{array}{r}55\\ \underline{32}\end{array}$

Subtract the following examples and check each answer by adding the subtrahend and remainder. Try to do as many examples as possible in ten minutes.

1. $21.06 7.86	**2.** $34.18 15.86	**3.** $91.02 78.15	**4.** $87.01 61.78
5. $230.10 197.15	**6.** $478.50 287.75	**7.** $516.25 319.50	**8.** $308.09 186.74
9. 84,965 58,096	**10.** 77,349 38,758	**11.** 46,870 19,436	**12.** 98,064 59,486
13. 80,407 42,186	**14.** 45,109 29,354	**15.** 72,033 36,487	**16.** 58,904 29,036
17. 50,000 29,482	**18.** 70,000 36,780	**19.** 90,000 42,076	**20.** 30,000 15,078
21. 60,406 43,819	**22.** 59,607 27,566	**23.** 65,342 37,085	**24.** 86,213 42,725
25. 745,312 486,908	**26.** 471,468 187,238	**27.** 789,395 463,798	**28.** 323,718 198,079
29. 206,908 175,609	**30.** 505,607 290,089	**31.** 306,702 190,065	**32.** 709,105 370,096
33. 300,021 147,602	**34.** 801,200 786,189	**35.** 400,105 250,780	**36.** 700,600 490,784

1. I bought a farm for $7634 and sold it for $9472. What did I gain?

2. How many dollars are $8142 minus $6785?

3. A man paid $6148 for a farm and $3862 for a house. How much more did he pay for the farm than for the house?

4. A merchant gained $4240 in business. If he then had $6410, how much had he first?

5. From $9246 take $7438.

6. How much larger is $8765 than $7874?

7. A farmer raised 1346 bu. of wheat one year and 1562 bu. the next year. How many more bushels did he raise the second year than the first?

8. A fruit dealer had 1142 baskets of peaches and sold 975 baskets. How many baskets had he left?

9. A man owns $8427 worth of property. If he owes $2728, how much is he worth?

10. The sum of two numbers is 8092. If one number is 4129, what is the other?

11. A man bought a house and lot for $5624. The house cost $4698. What did the lot cost?

12. A dealer bought some property for $6484 and sold it for $8726. What did he gain?

13. A father gave his son $7263 and his daughter $5264. How much more did he give his son than his daughter?

14. How much greater than 4569 is 8186?

15. What number must be added to 2675 to make 4128?

16. A coal dealer, having 7528 tons of coal, sold a part and had 1849 tons left. How many tons did he sell?

17. A merchant imported goods which he sold at a profit of $1736. If he received $5182 for them, what did they cost him?

18. The greater of two numbers is 1046. If their difference is 358, what is the less number?

19. If a man has $437.25, how much must he earn in order to have $1200?

1. *a.* 9×8 ft. = —— ft. *b.* \$7×6 = \$——. Read these two examples. In what 2 ways do we read the sign ×?

2. **Multiplication** is the process of repeating a number as many times as there are units in another number.

3. The **multiplicand** is the number repeated.

4. The **multiplier** shows how many times the multiplicand is to be repeated.

5. The **product** is the result of multiplication.

6. In example 1, *a* and *b*, which is the multiplier, and which is the multiplicand?

7. A number that does not refer to any particular thing is an **abstract number.**

8. In multiplication the multiplier is always an abstract number, and the product is always like the multiplicand.

Give products:

9. 4 ft.×12 = ——. **10.** 12 in.×9 = ——.

11. 7×8 qt. = ——. **12.** 9×8 pk. = ——.

13. \$7×9 = ——. **14.** 9×9 bu. = ——.

Multiply:

15. $\begin{array}{r} 9 \\ \underline{9} \end{array}$ **16.** $\begin{array}{r} 14 \\ \underline{2} \end{array}$ **17.** $\begin{array}{r} 50 \\ \underline{4} \end{array}$ **18.** $\begin{array}{r} 15 \\ \underline{3} \end{array}$ **19.** $\begin{array}{r} 90 \\ \underline{7} \end{array}$

20. $\begin{array}{r} 27 \\ \underline{10} \end{array}$ **21.** $\begin{array}{r} 45 \\ \underline{10} \end{array}$ **22.** $\begin{array}{r} 96 \\ \underline{10} \end{array}$ **23.** $\begin{array}{r} 87 \\ \underline{10} \end{array}$ **24.** $\begin{array}{r} 19 \\ \underline{10} \end{array}$

25. To multiply a number by 10, annex a cipher to the multiplicand.

26. $\begin{array}{r} 38 \\ \underline{100} \end{array}$ **27.** $\begin{array}{r} 76 \\ \underline{100} \end{array}$ **28.** $\begin{array}{r} 93 \\ \underline{100} \end{array}$ **29.** $\begin{array}{r} 67 \\ \underline{100} \end{array}$ **30.** $\begin{array}{r} 26 \\ \underline{100} \end{array}$

31. To multiply a number by 100, annex — — to the multiplicand.

It is taken for granted that the process of multiplication has been taught and explained in the preceding grade.

See how many examples you can multiply in 15 *minutes:*

1. 9,765,489 8	**2.** 8,937,546 7	**3.** 4,843,749 9	**4.** 5,683,654 6
5. 505,940 67	**6.** 850,039 78	**7.** 706,900 89	**8.** 736,584 97
9. 23,090 478	**10.** 40,308 568	**11.** 25,320 789	**12.** 50,902 867
13. 47,089 708	**14.** 70,896 809	**15.** 80,907 907	**16.** 90,608 807
17. 236,901 609	**18.** 510,090 709	**19.** 907,405 905	**20.** 740,530 708
21. 9764 8765	**22.** 6947 6879	**23.** 9804 2957	**24.** 5279 6708
25. 47,503 5,378	**26.** 97,489 6,784	**27.** 67,974 5,798	**28.** 27,069 6,908
29. 45,608 4,080	**30.** 70,809 7,009	**31.** 80,087 8,070	**32.** 90,009 9,009
33. 69,007 9,007	**34.** 40,309 7,080	**35.** 70,050 6,009	**36.** 98,008 8,090

1. Mr. B's income is $2496 a year and Mr. P's is 13 times as much. What is Mr. P's income?

2. There are 5280 ft. in a mile. How many feet are there in 967 miles?

3. If a man travels at the rate of 47 miles a day, how far can he travel in 309 days?

4. At the rate of 56 bu. an acre, how much corn can be raised on 468 acres of land?

5. If a carriage wheel revolves 465 times in running a mile, how many times will it revolve in running 94 miles?

6. A boat was loaded with 678 bales of hay, each weighing 209 lb. What was the weight of the cargo?

7. A planter raised 307 bales of cotton, each bale weighing 468 lb. How many pounds of cotton did he raise?

8. If a garrison of soldiers consume 925 lb. of bread every day, how many pounds will supply the garrison 708 days?

9. What will it cost to build 789 miles of railroad at $5687 a mile?

10. If a ship sails 276 miles a day, how far will it sail in 189 days?

11. A building-lot is 265 ft. long and 74 ft. wide. What is its area in square feet?

12. There are 2240 lb. in a long ton. How many pounds are there in 625 tons?

13. At $1965 each, what will 368 building-lots cost?

14. A coal dealer bought 785 tons of coal at $4.75 a ton. What was the entire cost?

15. There are 128 cubic feet in one cord of wood. How many cubic feet are there in 364 cords?

16. An army eats 2878 lb. of meat in one day. How many pounds will it eat in 316 days?

17. What will 95 tons of hay cost at $18.75 a ton?

18. If the divisor is $83, and the quotient is 249, what is the dividend?

1. *a.* 96 in. ÷ 12 in. = ——. *b.* $48 ÷ 6 = ——.

2. How is the sign ÷ read? Read example 1, *a* and *b*.

3. **Division** is the process of finding how many times one number is contained in another or it is the process of separating a number into equal parts.

4. Which definition applies to *a* in example 1? Which to *b*?

5. The **dividend** is the number that is to be divided or separated into parts.

6. The **divisor** is the number by which we divide.

7. The **quotient** is the result obtained by dividing.

8. The **remainder** is the part of the dividend remaining when the divisor is not contained an exact number of times.

9. A **concrete** number refers to some particular thing, as 7 bu., $5.

10. When both divisor and dividend are concrete they must be *like* numbers, and the quotient must be an abstract number.

11. When the divisor is abstract and the dividend concrete the quotient must be like the dividend.

12. Apply 10 and 11 to *a* and *b* in example 1.

13. The divisor is 7 qt., and the quotient is 6. What is the dividend?

14. The divisor is 5 and the quotient is 6 apples. The dividend is ——.

15. $12 \div 4$ $4\overline{)12}$ $\frac{12}{4}$ are all expressions of division.

Give quotient:

16. $72 \div 9$ **17.** $6\overline{)54}$ **18.** $\frac{84}{12}$ **19.** $28 \div 7$ **20.** $9\overline{)54}$

21. $96 ÷ 8 **22.** $7¢\overline{)63¢}$ **23.** $\frac{81}{9}$ **24.** 35 ft. ÷ 7 ft.

25. 121 ÷ 11 **26.** 72 in. ÷ 12 in. **27.** 45 min. ÷ 3 min.

28. 49 d. ÷ 7 d. **29.** 32 oz. ÷ 16. **30.** 32 oz. ÷ 16 oz.

It is understood that the process of division was taught in the preceding grade.

See how many examples you can do correctly in 15 minutes. Check your answers by multiplying the divisor and quotient and to the product adding the remainder. The sum should equal the dividend.

Find quotient:

1. 56,816 ÷ 67

2. 41,307 ÷ 49

3. 16,931 ÷ 89

4. 372,837 ÷ 93

5. 412,032 ÷ 87

6. 379,680 ÷ 48

7. 464,648 ÷ 58

8. 761,242 ÷ 78

9. 639,641 ÷ 49

10. 795,293 ÷ 79

11. 723,158 ÷ 39

12. 648,778 ÷ 89

13. 191,080 ÷ 281

14. 229,804 ÷ 292

15. 252,486 ÷ 498

16. 873,596 ÷ 869

17. 789,684 ÷ 847

18. 271,026 ÷ 478

19. 280,764 ÷ 396

20. 709,638 ÷ 506

21. 475,524 ÷ 612

22. 398,648 ÷ 501

23. 214,600 ÷ 290

24. 1,760,225 ÷ 905

25. 3,156,584 ÷ 722

26. 5,925,888 ÷ 643

27. 1,428,975 ÷ 675

28. 7,345,260 ÷ 876

29. If the dividend is $13,039, the quotient $138, and the remainder $67, what is the divisor?

30. The product of two numbers is 44,352 and one of them is 672. What is the other number?

31. The population of Massachusetts in 1890 was 2,805,346 and its area 8,315 square miles. What was the average population for each square mile?

32. The area of the state of Texas is 265,780 sq. mi., and that of Connecticut is 4,990 sq. mi. How many states the size of Connecticut could be made from Texas?

33. If the quotient is 973, the remainder 186, and the divisor 349, what is the dividend?

To multiply and divide when multipliers and divisors have ciphers at the right:

a. Multiply 24 by 1,200

$$\begin{array}{r} 24 \\ \underline{1200} \\ 48 \\ \underline{24} \\ 28800 \end{array}$$

a. Notice how the multiplier is placed.

. Divide 2,899 by 1,300

$$\begin{array}{r} 2.23 \\ 13\cancel{0}\cancel{0})\overline{28.99} \\ \underline{26} \\ 29 \\ \underline{26} \\ 39 \\ \underline{39} \end{array}$$

b. Cross off the ciphers in the divisor and point off in the dividend as many places as there are ciphers in the divisor.

1. Multiply 4,763 by 2,000; 1,200.
2. Divide 64,782 by 2,000.
3. Divide 460,076 by 400.

Multiply:

4. 794 by 400
5. 9,797 by 4,000
6. 1.06 by 200
7. 789 by 300
8. 6,468 by 8,000
9. 5,078 by 60
10. 988 by 700
11. 1,895 by 6,000
12. 9.248 by 1,000
13. 776 by 500
14. 6,759 by 9,000
15. 63.75 by 400

Divide:

16. 3,840 by 120
17. 3,600 by 1,800
18. 7,980 by 190
19. 145,600 by 1,300
20. 53,040 by 170
21. 6,001 by 1,700
22. 28,990 by 130
23. 760,000 by 1,900
24. 95,040 by 45,000
25. 282,500 by 2,500
26. 316,800 by 2,400
27. 4,899 by 230

1. Writing numbers by means of symbols or figures is called **notation.**

2. Reading numbers written in symbols or figures is called **numeration.**

3. We use the **Arabic System of Notation,** so called because it was introduced into Europe by the Arabs.

4. The system employs ten characters, called figures, to represent numbers, thus, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

5. The first of these characters is called cipher, zero or nought. The other characters are sometimes called digits.

6. A figure standing alone represents *units of the first order* or simply *units.* The figure at the left of units represents *tens of the unit,* or *units of the second order.* The next figure at the left is *hundreds,* or *units of the third order.*

7. Ten units of any order make one unit of the next higher order, and the orders increase in value from right to left. For this reason our system is called a **decimal system.**

8. For convenience in reading and writing numbers three orders form a period. Hundreds, tens and units form *units period.*

9. The next period is called *thousands period.* It is formed by hundred-thousands, ten-thousands, and thousands.

10. The next period is called *millions,* and the fourth period *billions.*

11. The fifth period is called *trillions,* and the sixth *quadrillions.* We seldom use numbers above millions period.

12. The different periods are separated from each other by a comma, called the *separatrix.*

13. The position occupied by any figure gives it its value. In the number 2,222, what is the value of each 2?

14. What does the zero show in each of the following numbers? 30? 306? 1074? 20,010?

15. In the number 2,323, of how much greater value is one 3 than the other? Is one 2 than the other?

BILLIONS' PERIOD				MILLIONS' PERIOD				THOUSANDS' PERIOD				UNITS' PERIOD						
Hundred-billions	Ten-billions	Billions		Hundred-millions	Ten-millions	Millions		Hundred-thousands	Ten-thousands	Thousands		Hundreds	Tens	Units	Decimal Point	Tenths	Hundredths	Thousandths
2	3	6	,	4	6	8	,	7	0	8	,	4	0	5	.	6	4	8

1. The number represented above is read: two hundred thirty-six billion, four hundred sixty-eight million, seven hundred eight thousand, four hundred five *and* six hundred forty-eight thousandths.

2. *In reading numbers observe three rules:*

a. Read each period as if it stood alone and then add the name of the period.

b. Do not read the zero. It merely indicates that that order is omitted.

c. Use the word *and* only in place of the decimal point.

3. *Notice the difference in reading:*

101,000 one hundred one thousand.
.101 one hundred one thousandths.
100.001 one hundred *and* one thousandth.

4. *Read the following:*

1. 1,020
2. 20,405
3. 3,906.7
4. 19,070.05
5. 203.
6. 200.3
7. .203
8. 200.003
9. 406,740,110
10. 760,809,708
11. 468,242,039
12. 105,436,106

1. Name the periods in order from units to millions.

2. Name the places in order from units to millions, and from units to thousandths.

Write in figures:

3. Three hundred million, ninety thousand, four *and* seventy-six thousandths.

4. Five hundred thirty-eight million, two hundred ten thousand, nine hundred fifty-three *and* one hundred six thousandths.

5. Six million, six thousand, six *and* six tenths.

6. Seven hundred million, seven hundred seven thousand, seven *and* seven thousandths.

7. Two thousand *and* two thousandths.

8. Six thousand, six hundred *and* six hundredths.

Read:

9. 205,000,004
10. 400,040,004.004
11. 8,808,080,008
12. 20,202,020.02
13. 760,080,096
14. 11,101,011.01
15. 400,500,206
16. 7,107,707.7
17. 302,786,386
18. 2,020,202.202
19. 673,050,293
20. 4,404,400.44

Write in figures:

21. 4 thousands, 4 tens, 2 units and 3 tenths.

22. 36 thousands, 5 hundreds, 1 unit and 2 thousandths.

23. 5 billions, 5 thousands, 5 hundreds and 5 hundredths.

Write in words:

24. 303
25. 99
26. 2,020
27. 120
28. 9.9
29. 4,040,030
30. 605
31. 100.001
32. 1,110,120.101

The following tables were studied in Part I, and are repeated here for reference if necessary.

Liquid Measure.

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

Dry Measure.

2 pints = 1 quart
8 quarts = 1 peck (pk.)
4 pecks = bushel (bu.)

U. S. Money.

10 cents (¢, ct.) = 1 dime.
10 dimes = 1 dollar ($).

Time Measure.

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (da.)
7 days = 1 week (wk.)
4 weeks = 1 month (mo.)
12 months = 1 year (yr.)

Avoirdupois Weight.

16 ounces (oz.) = 1 pound (lb.)
2000 pounds = 1 ton (T.)

Square Measure.

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)

Long Measure.

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
36 inches = 1 yard.

Cubic Measure.

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.).
27 cubic feet = 1 cubic yard (cu. yd.)

1. ¾ of an hour are how many minutes?

2. How many days are there in 9 weeks? In 12 weeks?

3. How many pecks are there in 32 quarts? In 72 quarts?

4. At 10¢ a peck, how much will 2 bu. of oats cost?

5. What is 1 quart of beans worth, if a peck is worth 64 cents?

6. In ¾ of a peck there are how many quarts?

7. In ¾ of a bushel there are how many pecks?

8. How many inches are there in ¾ of a foot?

9. How many inches are there in 9 ft. 6 in.?

10. How many pints are there in 6 quarts? In 12 gills?

11. How many quarts are there in 3 pecks? In 24 pints?

12. What part of a pound is 8 ounces?

13. What part of a bushel is 3 pecks?

14. How many half-dollars are there in $2.50?

15. A tower is 240 ft. high. How many yards is that?

16. A room is 8 yd. long and 5 yd. wide. What is the area of the floor?

17. If this same room is 3 yd. high, what is the area of one side? Of one end?

18. How many minutes is it from half past eight to nine o'clock?

19. After 16 quarts have been put into a bushel basket, how many more quarts are needed to fill it?

20. What will ½ bu. of potatoes cost at 25¢ a peck?

21. 3 quarts 3 pints of vinegar are how many pints?

22. What is the cost of 6 quarts of milk at 4¢ a pint?

23. How many weeks are there in 14 days? In 140 days?

24. What is the cost of 27 ft. of picture cord at 10¢ a yard?

25. What is the cost of 5 yd. of tape at 2¢ a foot?

26. How many pounds are there in 2½ tons?

27. How many cents are there in 30 dimes? How many dollars are there?

1. Find the area of the 6 faces of a 2-foot cube.

2. The perimeter of a 4-ft. square is —— feet.

3. The area of a 4-ft. square is —— square feet.

4. The perimeter of a rectangle 5 ft. by 3 ft. is —— feet.

5. The area of a rectangle 5 ft. by 3 ft. is —— sq. ft.

6. The area of a rectangle 10 in. wide and 4 in. long is —— square inches.

7. The area of a rectangle 2½ in. by 4 in. is —— sq. in.

8. A half-inch square is what part of an inch square? Illustrate by a drawing.

9. Letting 1 in. represent 1 ft., draw a rectangle 4 ft. by 3 ft. This is called *drawing to a scale*. We say the scale is 1 in. to 1 ft.

10. Draw a rectangle 24 ft. by 16 ft., scale ⅛ in. to a foot. How large a drawing have you made?

11. Make a drawing to represent a rectangle 12 in. by 10 in., scale ½. This means make each dimension of the drawing ½ of the given dimension.

12. Make a drawing of a 9-in. square. Scale ⅓. Give the dimensions of your drawing.

13. Represent the six sides of a 6-in. cube. Scale ⅓.

14. Represent the six sides of a rectanglar block, 12 in. by 8 in. by 4 in. Scale 1 in. to 4 in. Find the entire surface of the block and of the drawing.

15. How many feet is it one-half way round a flower bed which measures 15 ft. on each side and 9 ft. on each end? How many yards is it?

16. The area of a rectangle, 12 in. long, is 96 sq. in. How wide is the rectangle?

17. Alice is making a bed-quilt for her doll's bed, of pieces 2 inches square. If the quilt is 18 in. long, and 12 in. wide, how many rows of squares will there be lengthwise? How many pieces will there be in all?

18. Represent a rectangular piece of land 32 yd. long and 8 yd. wide, using a scale of ⅛ in. to a yard.

Change 9 lb. 3 oz. to ounces.

16 oz. in 1 pound.
9
144 oz. in 9 pound.
3 oz.
147 oz. in 9 lb. 3 oz.

Analysis

1 lb. = 16 oz.
9 lb. = 9 × 16 oz. = 144 oz.
144 oz. + 3 oz. = 147 oz.

Change 147 ounces to pounds and ounces.

9 times
16 oz.)147 oz.
144
3 oz. remainder

∴ 9 lb. 3 oz.

Since there are 16 oz. in a pound; in 147 oz. there are as many pounds as 16 oz. is contained *times* in 147 oz. which is 9 times and 3 oz. remainder.

Change:

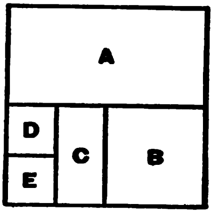
1. 7 lb. 5 oz. to ounces.
2. 14 gal. 3 qt. to quarts.
3. 28 qt. 1 pt. to pints.
4. 18 bu. 3 pk. to pecks.
5. 17 pk. 7 qt. to quarts.
6. 49 bu. to pecks.
7. 5 yd. to inches.
8. 14 yd. 2 ft. to feet.
9. 13 ft. 3 in. to inches.
10. 70 ft. to yards and feet.
11. 24 lb. 12 oz. to ounces.
12. 19 lb. 4 oz to ounces.
13. 63 gal. 3 qt. to quarts.
14. 24 gal. 1 qt. to quarts.
15. 98 ft. to inches.
16. 75 bu. to quarts.
17. 33 yd. to inches.
18. 135 gal. to quarts.
19. 19 ft. 11 in. to inches.
20. 18 bu. 3 pk. to pecks.
21. 7 qt. 1 pt. to pints.
22. 4 gal. 1 pt. to pints.
23. 69 oz. to pounds and ounces.
24. 82 qt. to gallons and quarts.
25. 47 pt. to quarts and pints.
26. 97 qt. to pecks and quarts.
27. 87 pk. to bushels and pecks.

1. Compare 18 and 6. Ill. 18 is 3 times 6. 6 is $\frac{1}{3}$ of 18.

2. **Ratio** is the relation or comparison of one quantity to another of the same kind. It is found by dividing the first quantity by the second.

3. What is the ratio of 36 in. and 9 in.?

4. What is the ratio of 1 gallon and 1 quart? If one quart of milk costs 6¢, what will 1 gallon cost?



5. Compare A with B. B with A. C with B. C with A. D with C. D with B.

6. Call A. 16. Give the value of B, C, D, E.

7. Call B 12. Give the value of A, C, D, E.

8. Call the whole square 64. Find each of the parts.

9. Call E 3. Find the value of the whole square.

10. What is the ratio of the whole square to E?

11. What is the ratio of 16 qt. to 4 qt.?

12. If 4 qt. of milk cost 30¢, what will 16 qt. cost?

(*Do not find the value of* 1 *qt., but find the ratio of* 16 *qt. to* 4 *qt.* 16 *qt. will cost* 4 *times* 30c. *or* $1.20.)

13. What is the ratio of 15 to 5? Of 5 to 15?

14. If 15 cords of wood cost $93, what will 5 cords cost?

15. If 5 bu. of potatoes cost $6, what will 15 bu. cost?

16. What is the ratio of 8 to 12? It is $8 \div 12 = \frac{8}{12} = \frac{2}{3}$.

17. If 12 yd. of cloth cost \$15, what will 8 yd. cost? What is $\frac{2}{3}$ of \$15?

18. What is the ratio of 3 pecks to 1 bushel?

19. What will 3 pk. of potatoes cost, if 1 bu. costs $1.20?

20. Compare $1\frac{1}{3}$ with $\frac{1}{3}$. If $\frac{1}{3}$ of a bushel of wheat weighs 20 lb., what will $1\frac{1}{3}$ bu. weigh?

21. If 3 pears cost 5¢, 12 pears will cost —— cents?

22. If 2 apples cost 3¢, 12 apples will cost —— cents?

If the pupils have any difficulty in answering these questions, continue to use the fractional disks as suggested in Part I.

1. What is $\frac{1}{4}$ of 12? 16? 20? 24? 80?

2. What are $\frac{3}{4}$ of 28? 32? 40? 48? 100?

3. 3 is $\frac{1}{4}$ of what number? 30 is $\frac{1}{4}$ of what number?

4. 40 and $\frac{1}{2}$ of 40 = ——. 30 and $\frac{1}{3}$ of 30 = ——.

5. 15 less $\frac{1}{5}$ of 15 = ——. 24 less $\frac{1}{6}$ of 24 = ——.

6. Compare $\frac{1}{2}$ with $\frac{1}{4}$.

7. If $\frac{1}{4}$ lb. of butter costs 8¢, what will $\frac{1}{2}$ lb. cost?

8. How many fourths of a circle will equal $\frac{1}{2}$ of it?

9. How many sixths of a circle will equal $\frac{1}{2}$ of it?
How many sixths will equal $\frac{1}{3}$?

10. By drawings prove that $\frac{1}{2}=\frac{2}{4}=\frac{3}{6}=\frac{4}{8}=\frac{5}{10}=\frac{6}{12}$.

11. Changing $\frac{1}{2}$ to $\frac{2}{4}$, $\frac{3}{6}$, etc., is called **changing a fraction to higher terms.**

12. Change $\frac{1}{3}$ to 9ths.

$$\frac{1\times3}{3\times3}=\frac{3}{9}$$

Learn: Multiplying both numerator and denominator by the same number does not change the value of a fraction.

13. Change $\frac{1}{4}$ to 12ths. $\frac{2}{3}$ to 6ths. $\frac{3}{4}$ to 8ths. $\frac{5}{6}$ to 12ths.

14. Change $\frac{4}{6}$ to thirds.

$$\frac{4\div2}{6\div2}=\frac{2}{3}$$

Learn: Dividing both numerator and denominator by the same number does not change the value of a fraction.

15. Changing $\frac{4}{8}$ to $\frac{1}{2}$ or $\frac{4}{6}$ to $\frac{2}{3}$ etc. is called **reducing a fraction to its lowest terms.**

16. Reduce the following fractions to their lowest terms: $\frac{2}{4}$, $\frac{3}{6}$, $\frac{4}{6}$, $\frac{6}{8}$, $\frac{2}{8}$, $\frac{5}{10}$, $\frac{2}{12}$, $\frac{3}{12}$, $\frac{6}{12}$.

17. Change $\frac{1}{2}$ to 12ths. $\frac{5}{15}$ to 3ds.

1. If we speak of $\frac{3}{4}$ of an apple, we must *think* of the apple as being divided into how many parts?

2. Which number then gives the *name* to the fraction and is therefore the **denominator?**

3. Which number tells us *how many* parts are used and is therefore the **numerator?**

4. In the following fractions name the numerator and denominator of each: $\frac{5}{6}$, $\frac{2}{3}$, $\frac{9}{12}$.

5. Expressions consisting of whole numbers and fractions are called **mixed numbers,** as $2\frac{1}{4}$, $4\frac{1}{5}$, $7\frac{7}{8}$.

REDUCTION

Changing the *form* of a fraction without changing its *value* is **reduction.**

Reduce to higher terms:

6. $\frac{2}{3}$ to fifteenths. **7.** $\frac{3}{4}$ to sixteenths.

Reduce to lower terms:

8. $\frac{11}{44}$. **9.** $\frac{30}{36}$. **10.** $\frac{9}{27}$. **11.** $\frac{16}{32}$. **12.** $\frac{15}{45}$.

Change $2\frac{1}{4}$ to 4ths.

$2\times\frac{4}{4}=\frac{8}{4}$.

$\frac{8}{4}+\frac{1}{4}=\frac{9}{4}$.

Since there are $\frac{4}{4}$ in 1, in 2 there are 2 times $\frac{4}{4}=\frac{8}{4}$, and in $2\frac{1}{4}$ there are $\frac{8}{4}+\frac{1}{4}=\frac{9}{4}$.

13. How many thirds are there in $3\frac{1}{3}$? In $4\frac{2}{3}$? In $7\frac{1}{3}$?

14. How many fourths are there in $2\frac{3}{4}$? In $4\frac{1}{4}$? In $3\frac{2}{4}$?

In $\frac{9}{2}$ there are how many wholes?

$\frac{9}{2}\div\frac{2}{2}=9\div2=4\frac{1}{2}$.

Since there are 2 halves in 1 whole, in 9 halves there will be as many wholes as 2 halves are contained times in 9 halves, that is 4 times, therefore there are 4 wholes and 1 half remaining.

15. 17 eighths = —— wholes and —— eighths.

Change to mixed numbers:

16. $\frac{19}{6}$. **17.** $\frac{8}{3}$. **18.** $\frac{21}{9}$. **19.** $\frac{35}{8}$. **20.** $\frac{30}{7}$.

1. Add $\frac{1}{2}$ and $\frac{1}{3}$.

$\frac{1}{2}=\frac{3}{6}$
$\frac{1}{3}=\frac{2}{6}$
$\frac{3}{6}+\frac{2}{6}=\frac{\quad}{6}$

To what common name or denominator can you change both fractions?

2. From $\frac{1}{3}$ take $\frac{1}{4}$.

$\frac{1}{3}=\frac{4}{12}$
$\frac{1}{4}=\frac{3}{12}$
$\frac{4}{12}-\frac{3}{12}=\frac{\quad}{12}$

How did we change both fractions to 12ths? Why did we do it?

Add:

3.	**4.**	**5.**	**6.**	**7.**
$4\frac{1}{2}$	$2\frac{1}{3}$	7	$7\frac{1}{4}$	$2\frac{5}{6}$
$3\frac{1}{2}$	$4\frac{1}{4}$	6	$4\frac{1}{2}$	7
4	$2\frac{3}{4}$	$4\frac{2}{3}$	$2\frac{3}{4}$	$4\frac{1}{3}$
6	$1\frac{2}{3}$	$2\frac{1}{3}$	5	8

Subtract:

8.	**9.**	**10.**	**11.**	**12.**
$17\frac{1}{2}$	$26\frac{1}{2}$	17	27	$9\frac{1}{5}$
$4\frac{1}{4}$	$9\frac{1}{3}$	$4\frac{1}{2}$	$9\frac{1}{3}$	$8\frac{1}{10}$

13.	**14.**	**15.**	**16.**	**17.**
$15\frac{1}{2}$	$11\frac{1}{2}$	$17\frac{1}{2}$	$11\frac{1}{3}$	$9\frac{1}{2}$
$6\frac{1}{4}$	$4\frac{1}{8}$	$8\frac{1}{3}$	$7\frac{1}{6}$	$2\frac{1}{6}$

18. Two times 1 bu. = —— bu. $2\times\frac{1}{8}=$ —— eighths.

19. Four times $\frac{5}{6}=$ —— sixths, which equal —— wholes and ——sixths.

20. Find the cost of $2\frac{1}{3}$ bu. of potatoes at 60¢ a bushel.

$$\begin{array}{r} \$\ .60 \\ \underline{2\frac{1}{3}} \\ .20 \\ \underline{1.20} \\ \$1.40 \end{array}$$

If 1 bu. is worth 60¢, $2\frac{1}{3}$ bu. are worth $2\frac{1}{3}\times\$.60$, that is, $2\times\$.60+\frac{1}{3}$ of \$.60.

21. Multiply 20 by $2\frac{1}{5}$. $\frac{1}{5}$ of $20=$ ——. $2\times20=$ ——. $2\frac{1}{5}\times20=$ —— + —— = ——.

22. When a gallon of milk costs 20¢, $4\frac{1}{2}$ gal. will cost ——.

23. Multiply $6\frac{1}{2}$ by 4. $4\times6=$ ——. $4\times\frac{1}{2}=$ ——. $4\times6\frac{1}{2}=$ —— + —— = ——.

24. $24\times2\frac{1}{2}=$ ——. **25.** $12\times3\frac{1}{3}=$ ——. **26.** $10\times4\frac{1}{5}=$ ——

1. How many inches are there in a foot? How many feet are there in a yard?

2. To the table of Long Measure add:

5½ yards = 1 rod (rd.)
16½ feet = 1 rod.
320 rods = 1 mile (m.)

3. Take a string 16½ ft. long, and see how many rods it is round the schoolroom.

4. How many yards are there in 462 feet?

5. How many feet are there in 960 inches?

6. How many inches are there in 25 yards?

7. How many feet are there in 4 rods?

8. How many feet are there in a mile? Since there are 16½ feet in a rod, in a mile there are 320 × 16½ ft. or —— ft.

9. How many yards are there in 40 rods?

10. How many inches are there in 2½ yards?

11. Name 2 objects in this room 1 rod apart.

12. A rod is a common unit of measurement. Practise till you can estimate quite accurately objects 1 rod apart, 2 rods apart, etc.

13. How many rods wide is the street in front of the schoolhouse? Measure it with your rod measure.

14. It is 4 rods from my house to my barn. How many feet long is a wire that reaches from one to the other?

15. How many yards are there in 2 rd. 3 yd.?

16. How many rods are there in 9 miles?

17. Take your string that is a rod long, and see how many pieces 6 in. long can be cut from it.

18. 7 yd. 2 ft. = —— feet.

19. 6 rd. 8 ft. = —— feet.

20. 1300 rd. = —— m. —— rd.

1. A grocer bought 16 bu. of potatoes at $1 a bushel. If he lost $\frac{1}{4}$ of a peck in each bushel by bad measurement, and sold the rest at 35¢ a peck, how much would he gain in all?

2. From $369.72 take $126.41.

3. Multiply 642 by 10. By 100.

4. Multiply 5246 by 18.

5. At $72 an acre, how many acres of land can be bought for $2664?

6. *Change the following to whole or mixed numbers:*
$\frac{14}{3}$, $\frac{21}{5}$, $\frac{32}{7}$, $\frac{45}{9}$, $\frac{48}{11}$.

7. $17-8\frac{2}{5}=$ ——.

8. Multiply $15\frac{8}{9}$ by 9.

9. Multiply $4\frac{7}{9}$ by 9.

10. What is the area of a rectangle 12 rd. by 18 rd.?

11. What is the perimeter of the same rectangle?

12. Find the number of square feet in the ceiling and walls of a room that is 36 ft. by 48 ft. and 12 ft. high?

13. What is $\frac{2}{3}$ of 630 bushels?

14. A farmer had 42 pigs. He kept 29 pigs, and sold the others at $5 each. How much did he receive for the pigs he sold?

15. I own 20 acres of land. If I keep $18\frac{1}{4}$ acres, and sell the rest at $40 an acre, how much do I receive for the part sold?

Subtract:

16. $49\frac{1}{2}$	**17.** $68\frac{1}{2}$	**18.** 10	**19.** 10	**20.** 30
$25\frac{1}{2}$	34	$9\frac{1}{2}$	$8\frac{1}{2}$	$27\frac{1}{2}$
21. 10	**22.** 25	**23.** 32	**24.** 54	**25.** 75
$5\frac{1}{2}$	$6\frac{1}{2}$	$18\frac{1}{2}$	$50\frac{1}{2}$	$74\frac{1}{2}$

26. Multiply 1836 by 3278.

27. At $90 each how many horses can I buy for $4320? How many for $2430?

1. If a man spends $28 in a month, what does he spend in a week?

2. If a man spends $21 in a week, what does he spend in a day?

3. 4 is $\frac{2}{3}$ of what number?

4. 8 is $\frac{4}{5}$ of what number?

5. 15 is $\frac{5}{8}$ of what number? 20 is $\frac{5}{9}$ of what number?

6. $2\frac{2}{5}$ is $\frac{1}{5}$ of what number? $4\frac{3}{7}$ is $\frac{1}{7}$ of what number?

7. $6\frac{5}{9}$ is $\frac{1}{9}$ of what number?

8. How can you divide 5 oranges equally among 3 persons?

9. If 4 yd. of cloth cost $2, what is that a yard?

10. A man sold a watch for $63, which was $\frac{7}{8}$ of what it cost him. How much did it cost him?

11. A man paid out $4, which was $\frac{2}{3}$ of all the money he had. How much money had he?

12. If $\frac{2}{3}$ of a pound of coffee cost 24 cents, how much will a pound cost? How many pints of peanuts, at 6¢ a pint, can be bought for the price of a pound of coffee?

13. 24 is $\frac{2}{3}$ of how many?

14. If 2 men can do a piece of work in 6 days, how long will it take 4 men? 4 men can do it in what part of the time?

15. If 5 oranges cost 25¢, what will 3 oranges cost?

16. If 4 yd. of cloth cost $12, what will 2 yd. cost?

17. 24 is $\frac{8}{9}$ of what number?

18. Mrs. Smith took $3\frac{1}{2}$ doz. eggs to the store, and sold them for 20 cents a dozen. With the proceeds she bought as many pounds of sugar at 6¢ a pound as she could buy, and brought the rest of her money home. How much did she bring home?

19. $7\frac{4}{9}$ is $\frac{1}{9}$ of what number?

20. A boy read at home 10 pages of history each school day. How many pages had he read at the end of a school month?

21. How much must a boy pay for 2 dozen papers at the rate of 3 for 2 cents?

22. How can you change $\frac{1}{3}$ to ninths?

1. If 33 pickets are used in building one rod of fence, how many pickets will be needed for a fence round a lot 22 rd. long and 16 rd. wide?

2. A soap maker had 24 lots of soap each containing 325 bars. How many boxes holding 40 bars each will it take to hold all the soap?

3. A man began business with $7148. At the end of 7 years he was worth $22,128. What was his yearly gain?

4. A merchant deposited $2478 in a bank at one time, and at another time $5176. If he then drew out $3785, how much remained in the bank?

5. A farmer received $385 for his wheat, $265 for his corn and $176 for his potatoes. He paid $358 for labor and $196 for other expenses. How much did he save?

6. A drover bought 46 cows at $27 each, 78 sheep at $9 each and 17 horses at $118. He sold them all for $4116. How much did he gain?

7. A's farm cost $5742, which was $1786 more than the cost of B's farm. Find the cost of both farms.

8. A man owns three houses. The first cost $2450, the second twice as much as the first and the third as much as the first and second together. Find the cost of all three houses.

9. If 16 men earn $560 a week, how much will 49 men earn in the same time and at the same rate?

10. A man bought 16 horses for $1632. He sold 12 of them at cost. What did he receive for those he sold?

11. A lady had $278 in her pocket-book. While out shopping she spent $86.50 at one store and $35.75 at another. How much had she left?

12. I bought a horse for $135 and kept it four months at an expense of $36.50. I then sold it for $215. How much did I gain?

13. By what number must 325 be multiplied in order to produce 10,725?

1. What is $\frac{1}{2}$ of 100? $\frac{1}{4}$ of 100? $\frac{1}{5}$ of 100?

2. In business it is convenient to think of anything as divided into 100 equal parts, called 100 per cent, because per cent means hundredths.

3. What per cent of anything is $\frac{1}{2}$ of it? This means what is $\frac{1}{2}$ of 100%. What per cent of anything is $\frac{1}{4}$ of it?

4. Per cent may be written as hundredths, or by using the sign %, as 5 per cent = .05 = 5%. It may be changed to a common fraction, thus $\frac{5}{100} = \frac{1}{20}$.

5. Write with the sign of per cent the following fractions: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{1}{5}$, $\frac{3}{5}$.

6. Change the following per cents to their equivalent common fractions: 33$\frac{1}{3}$%, 50%, 66$\frac{2}{3}$%, 75%.

7	3	9	1
10	12	5	8
6	2	11	4
4	28	44	20
36	16	32	12
24	40	8	48

7. Put 25%, 50%, 75%, in the center. Find the required per cent of the numbers in the lower half of the chart. Call the numbers in the upper half the given per cent and find the whole.

8. The difference between 25% of 32 and 50% of 20 is ——.

9. The sum of 20% of 10 and 33$\frac{1}{3}$ of 15 is ——.

10. 50% of a number is 30, 100% of the same number must be ——.

11. If 25 lb. is 25% of your weight, how much do you weigh?

12. \$.50 is 33$\frac{1}{3}$% of my money. I have \$——.

13. 25% of a day is —— hours.

14. 25% of a gallon is —— quart.

15. 50% of a minute is —— seconds.

1. Express as common fractions 10%, 20%, 25%, 50%, 33⅓%, 66⅔%, 75%, 60%.

2. What is 10% of \$80? \$40? \$100?

3. What is 20% of \$60? \$75? \$100?

4. What is 50% of 12 horses? Of \$60?

5. What is 33⅓% of 18? 24? 30? 60? 90?

6. I bought 2 doz. eggs, but 25% were spoiled. How many were good?

7. A farmer raised 50 bu. of corn, and sold 20% of it. How many bushels had he left?

8. How many gallons of molasses were left in a hogshead, containing 63 gal., after 33⅓% had been sold from it?

9. There are 400 boys and girls in a school. How many are there of each sex if 50% are boys?

10. A man bought a horse, agreeing to pay 25% of the price every month. How many months will it take him to pay the whole bill?

11. A received 20% of \$100, and B received 25% of the same sum. Which received the more, and how much more?

12. What per cent of 80 is 20? Of 20 is 10? Of 40 is 8?

13. 7 is what per cent of 14? Of 28? Of 35? Of 21?

14. A boy had 12 cents, and spent 3. What per cent did he spend? What per cent did he have left?

15. A man having \$50, paid \$10 for a coat. What per cent of his money did he spend?

16. If I buy a watch for \$10, and sell it for \$15, how many dollars do I gain? This is what per cent of the cost of the watch?

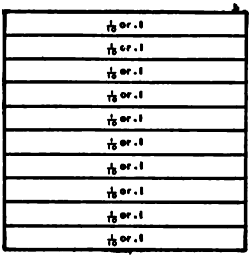
17. 20 is 10% of what number? 25 is 25% of what number?

18. A man paid \$400 toward a house, and the sum paid was 10% of the cost. What was the cost of the house?

19. 25% of a mile is how many rods?

20. 25% of a gallon is how many quarts?

21. 12½% of a bushel is how many quarts?



1. Into how many parts is this square divided. One row is then what part of the whole?

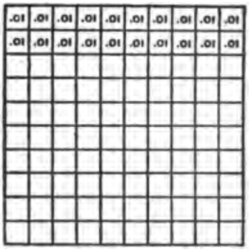
2. $\frac{1}{10}$ is also written .1. When written in this form it is called a **decimal fraction,** and the period before the 1 is called the **decimal point.**

3. Write 8 tenths, 5 tenths, 2 tenths.

4. 4.6 is called a **mixed decimal.** It is read four *and* six tenths. The decimal point is read *and.*

5. The first figure at the right of unit's figure is called *tenths,* because it takes 10 of them to make a unit.

6. Read the following as mixed decimals, and as tenths: 2.6; 1.7; 5.2.



7. How many small squares are there in the large square? Each is then what part of the large square?

8. The second figure at the right of units is called *hundredths.*

9. Show what part of the large square is represented by .3; .25; .5; .75.

10. Write 1 and 6 tenths. How many decimal places (figures at the right of the decimal point) does it take to write tenths?

11. Write 4 and 2 hundredths. How many decimal places are needed for hundredths?

12. Write 1 and 2 tenths. Read it as tenths.

13. Write three tenths, five hundredths. Read it as hundredths.

1. Name the first and second decimal places.

2. The third decimal place is called *thousandths*, the fourth *ten-thousandths*, the fifth *hundred-thousandths*, and the sixth *millionths*.

3. Read 3.106. It is three *and* one hundred six thousandths. Read the decimal first as a whole number, then give it the name of the last decimal place.

NOTE:—Since we rarely use decimals of more than three places, give especial drill in reading and writing tenths, hundredths and thousandths.

Read the following:

4. 2.05 **5.** .205 **6.** 20.05
7. .101 **8.** 100.001 **9.** 400.004
10. .72 **11.** .702 **12.** 305.005
13. 500.05 **14.** 5.5 **15.** .505

16. Write .5. Place a cipher after it. Compare .5 and .50. Annexing a cipher to a decimal has what effect upon the decimal?

17. Write .5. Place a cipher between the 5 and the decimal point. Compare .5 and .05. Prefixing a cipher to a decimal has what effect upon the value of the decimal?

Learn: Annexing a cipher to a decimal does not change the value of the decimal. Prefixing a cipher to a decimal divides the decimal by 10.

Write decimally:

18. Five and seventy-five hundredths.

19. Four and two tenths; two and four hundredths.

20. Six and six thousandths; one hundred one thousandths.

21. Eight hundred five thousandths; eight hundred and one thousandth.

22. One hundred five hundredths; two hundred six tenths.

23. $\frac{7}{10}$ **24.** $\frac{36}{100}$ **25.** $\frac{17}{1000}$ **26.** $\frac{81}{10}$
27. $7\frac{3}{10}$ **28.** $86\frac{5}{100}$ **29.** $19\frac{26}{1000}$ **30.** $5\frac{1}{1000}$

Add 1.6; 20.06; 1.105; .5; 9.46.

1.6
20.06
1.105
.5
9.46
―――
32.725

For convenience we arrange the numbers so that the decimal points are in a column. This brings units under units, tenths under tenths, etc. Add as in integers, remembering to place the decimal point in the sum.

From .1 take .057

.100
.057
―――
.043

Arrange the numbers in the same way as in addition. We annex ciphers to the minuend, since it does not affect the value of the decimal. Subtract as in integers, writing the decimal point in the difference.

Add:

1. 7.06; 0.761; 5.3; 5.04; 12.068.

2. 0.008; 0.507; 1.061; 0.054; 100.01.

3. 5.01	**4.** 0.4	**5.** 0.701	**6.** 0.506
4.206	0.604	7.05	7.685
7.063	1.26	0.58	7.07
30.05	8.67	1.028	10.029

Subtract:

7. .75 and .07 **8.** 6.16 and 4.05

9. 10.05	**10.** 11.1	**11.** 6.11	**12.** 8.08
6.34	7.05	4.73	6.36

13. 2.46 − .705 **14.** .901 − .009

15. .064 − .007 **16.** 1.01 − .095

17. 17 + 0.76 + 7.01 + 28.2 + 0.005 + 71.01 = ?

18. From five thousand and sixty-five hundredths take four hundred ten and fifty-one thousandths.

19. The length of a rectangular court is 78.5 ft., and its width is 36.75 ft. What is the perimeter of the court? How much does its length exceed its width?

LESSON 33 *TO MULTIPLY AND DIVIDE DECIMALS BY INTEGERS*

MULTIPLICATION

Multiply 5.05 by 4.

$$\begin{array}{r} 5.05 \\ 4 \\ \hline 20.20 \end{array}$$

The only direction that need be given is to place the decimal point in the product directly beneath the point in the multiplicand, since hundredths multiplied by an integer will produce hundredths.

Multiply:

1. 25.05 by 5
2. 56.06 by 8
3. 16.25 by 7
4. 39.079 by 9
5. 46.067 by 6
6. 57.209 by 9
7. 60.09 by 69
8. 32.06 by 46
9. 50.49 by 74
10. 37.59 by 72
11. 83.12 by 43
12. 47.06 by 37
13. 3.872 by 48
14. 2.904 by 69
15. 8.945 by 56
16. 6.007 by 57
17. 2.007 by 82
18. 5.600 by 24
19. 84.009 by 69
20. 20.076 by 46
21. 50.405 by 82

DIVISION

Divide 46.06 by 7.

$$\begin{array}{r} 6.58 \\ 7\overline{)46.06} \end{array}$$

If the quotient is placed above the dividend the decimal points come under each other. Pupils have been familiar with decimals for some time in connection with their work in U. S. money.

Divide:

22. 8.12 by 4
23. 2.16 by 6
24. 4.02 by 6
25. 1.82 by 7
26. 9.44 by 8
27. 3.96 by 9
28. .0368 by 8
29. .0416 by 2
30. .0537 by 3
31. 12.25 by 35
32. 20.25 by 45
33. 77.76 by 36
34. 7.380 by 12
35. 94.08 by 48
36. 42.864 by 24
37. 10.867 by 46
38. 68.48 by 32
39. 39.702 by 78
40. 599.04 by 78
41. 267.02 by 69
42. 467.16 by 68
43. 220.40 by 38
44. 323.00 by 38
45. 19.008 by 27

MULTIPLYING AND DIVIDING DECIMALS BY 10, 100, *ETC. ORAL*

Lesson 34

1. Compare 24 and 2.4. Compare 4 and .4. 24 is how many times 2.4? 4 is how many times .4?

2. What effect has moving the decimal point one place to the right?

Learn: To multiply a decimal by 10, *we move the decimal point one place to the right.*

3. Moving the decimal point two places to the right would multiply it by ——. To multiply by 1000 we move the point how many places to the right?

4. Compare 4 and .4. By what has 4 been divided to produce .4?

Learn: To divide a decimal by 10, *we move the decimal point one place to the left.*

5. How many places must we move the point to the left to divide by 100? To divide by 1000?

Multiply the following by 10 *and* 100 *by moving the decimal point:*

6. 45.75 **7.** 26.9 **8.** 18.85 **9.** 64.7

10. 303.4 **11.** 19.09 **12.** 87.07 **13.** 65.05

14. .8 **15.** .68 **16.** .9 **17.** .14

18. .90 **19.** 48.12 **20.** 95.19 **21.** 60.2

22. 84.32 **23.** 75.01 **24.** 34.5 **25.** 5.5

Divide the following by 10 *and* 100 *by moving the decimal point:*

26. 62.02 **27.** 37.62 **28.** 57.36 **29.** 47.33

30. 3.52 **31.** 37.75 **32.** 80.06 **33.** 45.08

34. 84.08 **35.** 16.07 **36.** 2.9 **37.** 1.96

38. 15.34 **39.** 65.04 **40.** 9.08 **41.** 16.66

42. 95.37 **43.** 35.75 **44.** 26.37 **45.** 19.08

LESSON 35 *MULTIPLYING AND DIVIDING BY MULTIPLES OF* 10

Multiply 7.05 by 70

$$\left.\begin{array}{r}7.05\\70\end{array}\right\} = \left\{\begin{array}{r}70.5=\\ \underline{7}\\ 493.5\end{array}\right.$$

Multiplying by 70 is the same as multiplying by 10 and 7. 7.05×10=70.5. 70.5×7 =493.5.

Divide 79.2 by 80

$$\begin{array}{r}0.99=\\ 8\overline{)7.92}\end{array}$$

Dividing by 80 is the same as dividing by 10 and 8. 79.2÷10=7.92. 7.92÷8=.99.

	Multiply:		*Divide:*
1.	7.065 by 80	**2.**	90.4 by 80
3.	6.09 by 90	**4.**	4.08 by 60
5.	4.06 by 80	**6.**	91.68 by 80
7.	9.08 by 60	**8.**	7.658 by 70
9.	4.236 by 70	**10.**	6.165 by 50
11.	428.5 by 40	**12.**	7.805 by 50
13.	7.016 by 60	**14.**	86.31 by 70
15.	73.06 by 30	**16.**	65.36 by 80
17.	2.183 by 290	**18.**	725.3 by 350
19.	9.556 by 890	**20.**	837.5 by 430
21.	80.09 by 370	**22.**	100.04 by 990
23.	16.07 by 430	**24.**	62.15 by 550
25.	307.5 by 160	**26.**	903.4 by 820
27.	6.094 by 380	**28.**	56.12 by 610
29.	486.2 by 7800	**30.**	8443.75 by 3500
31.	70.016 by 4900	**32.**	1693.44 by 3600
33.	62.025 by 6700	**34.**	4645.00 by 3200
35.	6.071 by 46,700	**36.**	209.576 by 6800

37. A man received $55.50 for 30 days' work. Find his day's wages.

38. Find the cost of 20 dining-room chairs at $3.95 each.

1. A farmer having 80 sheep, lost 25% of them. How many sheep did he lose?

2. What is $33\frac{1}{3}\%$ of 60 bushels of corn?

3. What is 50% of 36 horses?

4. If I buy hats at $5 each, and sell them at $4 each, what part do I lose? What per cent do I lose?

5. Three-fourths of a number is what per cent of it?

6. 7 oranges are 25% of how many oranges?

7. James gave $\frac{1}{2}$ of a pear to William, $\frac{1}{3}$ to George, and kept the rest himself. How much did he give away? How much did he keep?

8. If 2 bbl. of apples are worth $4, what are 8 bbl. worth?

9. What will 3 yd. of cloth cost if 8 yd. cost $32?

10. Two men, A and B, are 21 miles apart. A travels 5 miles an hour, and B follows him, traveling 8 miles an hour. How many miles does B gain on A in one hour? In how many hours will B overtake A?

11. How many tables at $9 each can be bought for $63?

12. If 15 is $\frac{3}{4}$ of some number, what is $\frac{1}{4}$ of the same number?

13. 24 is $\frac{3}{8}$ of what number?

14. 24 is $\frac{6}{7}$ of what number?

15. 25 is $\frac{5}{8}$ of what number?

16. 36 is $\frac{6}{7}$ of what number?

17. 20 is $\frac{5}{6}$ of what number?

18. 27 is $\frac{9}{10}$ of what number?

19. 15 is $\frac{3}{7}$ of what number?

20. If $\frac{5}{7}$ of a barrel of fish cost $10, what will 1 barrel cost?

21. 8 is $\frac{4}{5}$ of what number?

22. 6 is $\frac{2}{3}$ of what number?

23. A is ten years old, which is $\frac{1}{5}$ of B's age. Find B's age.

24. How many thirds are there in $3\frac{1}{3}$? In $4\frac{1}{3}$?

25. Name 6 numbers that will divide 24.

1. A man had $6300. He paid $4200 for a house, $475.50 for repairs, and $264.75 for furniture. How much money had he left?

2. A man sold a horse for $175, and lost $35. What did it cost? How much would he have gained or lost by selling the horse for $190?

3. If 4 tons of coal cost $25.52, what will 42 tons cost?

4. Find the cost of 368 bbl. of flour at $$4\frac{3}{8}$ a barrel.

5. Find the cost of 208 yd. of cloth at $$\frac{3}{8}$ a yard.

6. Find the cost of $508\frac{1}{2}$ bu. potatoes at 62¢ a bushel.

7. Find the cost of $62\frac{1}{4}$ doz. eggs at 16¢ a dozen.

8. Find the cost of $12\frac{3}{8}$ acres land at $160 an acre.

9. I bought at one time $7\frac{7}{8}$ lb. of meat, and at another time $5\frac{3}{4}$ lb. What did it all cost at 12¢ a pound?

10. A man had $$16\frac{1}{4}$. He spent $$4\frac{3}{8}$ at one time, and $$6\frac{1}{2}$ at another time. How much money had he left?

11. If $\frac{1}{12}$ of a lot of goods is worth $360, what is $\frac{1}{3}$ of the lot worth? $\frac{1}{4}$?

Add:

12.	**13.**	**14.**	**15.**	**16.**
$5\frac{7}{8}$	$3\frac{1}{4}$	$7\frac{5}{9}$	$46\frac{1}{2}$	$16\frac{7}{12}$
$2\frac{3}{4}$	$7\frac{2}{3}$	$9\frac{1}{3}$	$24\frac{4}{5}$	$18\frac{3}{4}$
$4\frac{1}{2}$	$8\frac{5}{6}$	$11\frac{1}{9}$	$13\frac{3}{10}$	$65\frac{1}{2}$
$5\frac{5}{8}$	$10\frac{5}{12}$	$16\frac{2}{3}$	$46\frac{3}{5}$	$38\frac{2}{3}$
$6\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{7}{9}$	$14\frac{1}{2}$	$14\frac{1}{4}$

17. What is the cost of 3 pk. 5 qt. of apples at 24¢ a peck?

18. If 50 bbl. of sugar cost $175, what do 25 bbl. cost?

19. If 1 hat cost $2.50, what will 50 hats cost at the same price?

20. A roll of ribbon is 50 ft. long. What is it worth at 9¢ a yd.?

21. A rectangular piece of land 20 ft. long and $8\frac{1}{2}$ ft. wide contains how many square feet? How many feet of fence will it take to fence it?

1. *Give sums:*

a. 57+16 *b.* 49+18 *c.* 67+27 *d.* 75+14
e. 13+78 *f.* 17+43 *g.* 14+36 *h.* 18+56
i. 25+17 *j.* 66+14 *k.* 16+26 *l.* 48+12
m. 18+25 *n.* 14+17 *o.* 12+31 *p.* 27+16

2. *Give differences:*

a. 66−17 *b.* 31−25 *c.* 85−50 *d.* 67−18
e. 54−36 *f.* 87−19 *g.* 50−14 *h.* 45−36
i. 60−15 *j.* 66−48 *k.* 84−56 *l.* 37−14
m. 46−37 *n.* 75−15 *o.* 70−18 *p.* 74−57

3. *Give products:*

a. 14×4 *b.* 6×15 *c.* 14×6 *d.* 8×71
e. 18×6 *f.* 3×19 *g.* 21×7 *h.* 6×13
i. 24×4 *j.* 5×15 *k.* 70×7 *l.* 6×15
m. 15×2 *n.* 4×21 *o.* 12×8 *p.* 5×17

4. *Give quotients:*

a. 45÷3 *b.* 42÷7 *c.* 76÷4 *d.* 60÷4
e. 88÷4 *f.* 75÷5 *g.* 112÷7 *h.* 92÷4
i. 56÷8 *j.* 98÷2 *k.* 70÷5 *l.* 78÷3
m. 90÷6 *n.* 80÷5 *o.* 48÷3 *p.* 56÷4

5. *Give remainders:*

a. $24\frac{3}{4}-4\frac{1}{4}$ *b.* $60-\frac{1}{2}$ *c.* $40-\frac{1}{4}$ *d.* $16-\frac{1}{2}$
e. $50-2\frac{1}{2}$ *f.* $40-5\frac{3}{4}$ *g.* $30-2\frac{1}{2}$ *h.* $28-1\frac{3}{4}$
i. $4-2\frac{1}{6}$ *j.* $6-1\frac{1}{4}$ *k.* $7-1\frac{1}{9}$ *l.* $8-6\frac{1}{8}$
m. $11-7\frac{1}{2}$ *n.* $24-1\frac{1}{4}$ *o.* $21-10\frac{1}{2}$ *p.* $9-1\frac{2}{3}$

6. *Give results:*

a. 46+20+30−10−30+40+10−80+40−50.
b. 82−40−30+50+20−40−10+20+30−40.
c. 49+30−20+40−50+60−40−10+30+20.
d. 15+20+30−40+50−20+30−60−10+60.
e. 42−30+60−30−30+50+30−40−30+20.

Give products:

1. 15×100
34×100
29×100
45×100

2. 65×100
67×100
41×100
79×100

3. 98×100
78×100
72×100
89×100

4. A woman buys 3 lb. of butter at 30¢ a pound, and gives the grocer a 50-cent piece. How much more must she pay?

5. A man owns a farm of $\frac{3}{4}$ of 80 acres. How much has he left after selling 40 acres?

6. What is the cost of 4 pieces of silk, 20 yd. in a piece, at 50¢ a yard?

7. A girl had 80 cents. She bought a doll for 40 cents, and spent the rest for candy at 20¢ a pound. How many pounds did she buy?

8. If sugar costs 4¢ a pound what is the cost of 21 pounds?

9. If vinegar is 20¢ a gallon, how many quarts can I get for 15 cents?

Give results:

10. $\frac{2}{3} \times 64$
$8 \times 6\frac{1}{2}$

11. $63 \div 7$
$72 \div 8$

12. 8×9
9×6

13. $100 - 36$
$15 + 18$

14. If a man receives $800 for 4 horses, sold at the same price, how much does he receive for 1 horse?

15. Add 5 ft. 6 in. and 3 ft. 6 in.

16. If meat costs 16¢ a pound, what is the cost of 1 pound 7 ounces?

17. What is the cost of four pairs of shoes at $\$3\frac{1}{2}$ a pair?

18. If tea costs 80 cents a pound, how much does a pound and three-quarters cost?

19. Find the cost of 9 lb. of tea at $\$\frac{1}{2}$ a pound and of 20 doz. eggs at $\$\frac{1}{4}$ a dozen.

Give sum:

20. $1\frac{1}{2} + \frac{1}{2}$
$1\frac{1}{2} + 1\frac{1}{2}$

21. $1\frac{1}{2} + 2\frac{1}{2}$
$2\frac{1}{2} + 2\frac{1}{2}$

22. $1\frac{3}{4} + \frac{1}{4}$
$3\frac{1}{2} + 1\frac{1}{4}$

23. $2\frac{1}{4} + 3\frac{1}{2}$
$3\frac{1}{4} + 3\frac{1}{2}$

The questions have been intentionally omitted from the problems on this page, that the pupils may gain power in determining first *what* can be found from given data, and second *how* to find it. Do not ask the questions for the pupils. Have them read the statements and then answer some questions which they have asked themselves. Lessons designed for this purpose will be marked simply statements.

1. A grocer sold 118¾ lb. of flour to one customer, 106⅞ lb. to another, and 230½ lb. to another.

2. I bought a barrel of kerosene oil containing 42 gal. for $6.30. I sold it for 16½¢ a gallon.

3. A farmer sold ⅛ of his farm of 224 acres at $52.25 an acre.

4. A man had 10.5 yd. of cloth, and used 4.15 yd. to make a suit.

5. A bought of B 498 acres of land at $37 an acre, and gave in payment a house worth $2250, a factory worth 4 times as much, and the rest in money.

6. A man bought a farm for $6450, giving in exchange a house worth $4500, a note for $1150, and paying the difference in money.

7. A merchant bought 864 bu. of wheat for $622.08, and sold it at $0.95 a bushel.

8. A man who had 256 gal. of vinegar, put it into barrels, each holding 32 gal.

9. A farmer, having 600 sheep, sold 215 of them to a butcher, and 310 to another farmer.

10. Bought a pair of boots for $4.62, an umbrella for $1.75, a pair of gloves for $0.87, a necktie for $1, and some collars for $.62.

11. A man had $60, and gave 33⅓% of it to his daughter.

12. A dealer sold 20 doz. pairs of shoes at $1.75 a pair.

13. A room is 18 ft. long, 14 ft. wide, and 12 ft. high.

14. A carload of 620 bu. of oats was bought for $175, and sold for 35¢ a bushel.

15. One week a merchant gained $2200, the next week he lost $816; the third week he lost $528, but the fourth week he gained $1719.

Time.	Recitation.	Study.
9.00- 9.10	Opening Exercises.	
9.10- 9.40	A. Arithmetic.	B. Study Reading.
9.40-10.10	B. Arithmetic.	A. Study Reading.
10.10-10.25	A. Language.	B. Study Language.
10.25-10.40	B. Language.	A. Study Language.
10.40-10.55	Recess.	
10.55-11.15	A. Reading.	B. Study Arithmetic.
11.15-11.35	B. Reading.	A. Study Arithmetic.
11.35-11.40	Calisthenics.	
11.40-11.45	Study Spelling.	
11.45-12.00	Music.	
1.30- 1.45	Writing.	
1.45- 2.05	A. Geography.	B. Study Geography.
2.05- 2.25	B. Geography.	A. Study Geography.
2.25- 2.30	Calisthenics.	
2.30- 2.40	Spelling.	
2.40- 3.00	Drawing.	
3.00- 3.25	Nature Study or Science.	
3.25- 3.30	Memory Gems.	

1. How long is the morning session? The afternoon session?

2. How many hours is school in session during the day?

3. How much time does each pupil give to preparing and reciting his arithmetic lesson?

4. Answer the same question for the other studies.

5. What part of the day does each pupil give to arithmetic?

6. If there are 10 examples in the arithmetic lesson how many minutes ought a pupil to allow to each example?

7. What part of the day does each pupil give to language?

8. What part of an hour is given each day to spelling?

9. The time given to spelling is what part of the time given to language?

10. How much time is given during the day to recess and calisthenics?

11. How long is the noon intermission?

Give answers quickly:

1. *a.* $\frac{1}{2}+\frac{1}{2}$ **2.** *a.* $1-\frac{1}{2}$ **3.** *a.* $10\frac{1}{2}+3\frac{1}{2}$
b. $2\frac{1}{2}+\frac{1}{2}$ *b.* $7\frac{1}{2}-2\frac{1}{2}$ *b.* $\frac{1}{2}+9\frac{1}{2}$
c. $1\frac{1}{2}+2\frac{1}{2}$ *c.* $6-1\frac{1}{2}$ *c.* $7\frac{1}{2}+7\frac{1}{2}$

4. A man traveled $1\frac{1}{2}$ miles north, and returned. He then traveled $\frac{3}{4}$ mile east. How far did he travel?

5. The girls in the cooking room used $3\frac{1}{4}$ lb. of butter last week, and $2\frac{1}{2}$ lb. this week. How many pounds did they use in the two weeks?

Perform the following and add $2\frac{1}{2}$ to each result:

6. $4\times6\frac{1}{2}$ **7.** $6\times7\frac{1}{2}$ **8.** $7\frac{1}{2}\times8$ **9.** $4\frac{1}{2}\times9$
10. $2\frac{1}{2}\times6$ **11.** $4\frac{1}{2}\times10$ **12.** $6\times3\frac{1}{2}$ **13.** $6\times3\frac{1}{3}$

14. At $3\frac{1}{2}$¢ a pint, how much will 2 qt. of milk cost?

15. One boy lives $\frac{3}{4}$ m. from school and another boy 2 times as far. How far from the school does the second boy live?

16. How many halves are there in 2? $3\frac{1}{2}$? 7? $5\frac{1}{2}$? $8\frac{1}{2}$? 11? $9\frac{1}{2}$? 6?

17. $2\frac{1}{2}$ is $\frac{1}{2}$ of what number? $4\frac{3}{4}$ is $\frac{1}{2}$ of what number?

18. Ralph earned \$$2\frac{1}{5}$ each week carrying papers. This is $\frac{1}{2}$ of what his brother earned. Find how much the brother earned.

Give products:

19. *a.* $2\frac{3}{4}\times4$ **20.** *a.* $4\times2\frac{1}{2}$ **21.** *a.* $2\frac{3}{4}\times8$ **22.** *a.* $2\frac{2}{3}\times9$
b. $2\frac{2}{3}\times3$ *b.* $6\times1\frac{1}{3}$ *b.* $3\frac{1}{5}\times10$ *b.* $1\frac{5}{6}\times6$

23. If $\frac{1}{2}$ yd. of cloth costs 20¢, what will be true of 10¢? 40¢? 1 yd.? $2\frac{1}{2}$ yd.?

24. When $\frac{3}{4}$ of a pound of tea costs 30¢, what will be true of $\frac{1}{4}$ lb.? $\frac{1}{2}$ lb.? 1 lb.? $1\frac{1}{2}$ lb.? 10¢? 20¢?

25. How many eighths are there in $\frac{1}{2}$? $\frac{3}{4}$? $1\frac{1}{2}$? $3\frac{3}{8}$? $4\frac{1}{4}$? $2\frac{1}{2}$? $6\frac{1}{4}$? $2\frac{5}{8}$?

26. Find the cost of $2\frac{1}{3}$ doz. bananas at 12¢ a dozen.

27. There are 60 exercises on this page. If you solve correctly $\frac{4}{5}$ of them, how many will you solve?

Note: Operations in simple fractions call for some knowledge of factoring. This topic should be taught here only as far as necessary to explain its use in connection with fractions.

1. What two numbers multiplied together give 6 as their product?

2. Of what two numbers is 10 the product? 15? 14?

3. Of what three numbers is 8 the product? 27? 30?

4. Numbers that multiplied together produce a given number are called its **factors.** A factor then is a number that *exactly divides* another number.

5. What are the factors of 12? 9? 18? 20?

6. **Factoring** is the process of separating a number into its factors.

7. **A prime number** is a number that has no factors except itself and one, as, 2, 3, 5, 7, 11, etc.

8. **A composite number** is a number that contains other factors, as: 6, 12, 15, 18, etc.

9. A number is exactly divisible:
By 2, if the unit's figure is 0 or is divisible by 2.
By 3, if the sum of the digits is divisible by 3.
By 5, if the unit's figure is 5 or 0.

10. From the following select the numbers that are divisible by 2; 3; and by 5:

24 112 720 500 132 1682
48 215 816 625 165 1320

11. Find the prime factors of 28.

2)28
2)14
7)7
1

What prime number will divide 28? Dividing by 2, what is the quotient? What prime number will divide 14? Dividing by 2 what is the quotient? The prime factors then of 28 are 2, 2, and 7.

$2 \times 2 \times 7 = 28$.

Find the prime factors of:

12. 210 **13.** 42 **14.** 60 **15.** 72 **16.** 45
17. 132 **18.** 64 **19.** 96 **20.** 75 **21.** 84

1. Find the sum of $7\frac{3}{4}$, $2\frac{7}{8}$, $8\frac{5}{12}$, $2\frac{9}{16}$.

$$\begin{array}{r|l}
2) & 4-8-12-16 \\ \hline
2) & 2-4-\ \ 6-\ \ 8 \\ \hline
2) & 1-2-\ \ 3-\ \ 4 \\ \hline
2) & 1-1-\ \ 3-\ \ 2 \\ \hline
3) & 1-1-\ \ 3-\ \ 1 \\ \hline
 & 1-1-\ \ 1-\ \ 1
\end{array}
\qquad
\begin{array}{r|l}
 & \underline{48} \\
7\frac{3}{4} & 36 \\
2\frac{7}{8} & 42 \\
8\frac{5}{12} & 20 \\
2\frac{9}{16} & 27 \\ \hline
21\frac{29}{48} & \frac{125}{48}=2\frac{29}{48}
\end{array}$$

$$2\times2\times2\times2\times3=48$$

When we can not tell the new denominator by inspection, we can find it as shown here. Arrange the denominators as indicated and find their prime factors. The product of the prime factors will be our new denominator.

Note: Pupils will seldom use Least Common Multiple, except in a few examples in fractions. When necessary they can use the method above without further explanation.

Add:

$$\begin{array}{llllllllll}
\textbf{2.} & 7\frac{1}{3} & \textbf{3.} & 9\frac{3}{8} & \textbf{4.} & 8\frac{3}{5} & \textbf{5.} & 8\frac{7}{8} & \textbf{6.} & 46\frac{11}{36} \\
 & 2\frac{1}{2} & & 5\frac{1}{5} & & 7\frac{1}{3} & & 5\frac{2}{3} & & 71\frac{13}{24} \\
 & 8\frac{1}{9} & & 2\frac{1}{4} & & 2\frac{1}{2} & & 6\frac{3}{4} & & 85\frac{7}{18} \\
 & \underline{4\frac{1}{6}} & & \underline{6\frac{1}{2}} & & \underline{5\frac{3}{4}} & & \underline{4\frac{5}{6}} & & \underline{98\frac{11}{12}}
\end{array}$$

7. From $48\frac{2}{9}$ take $26\frac{11}{12}$.

$$\begin{array}{l}
48\frac{2}{9}\ =48\frac{8}{36}=47\frac{44}{36} \\
\underline{26\frac{11}{12}}=\underline{26\frac{33}{36}}=\underline{26\frac{33}{36}} \\
\qquad\qquad\qquad\quad\ 21\frac{11}{36}
\end{array}$$

If necessary find the common denominator as shown above. Change to similar fractions. We cannot take $\frac{33}{36}$ from $\frac{8}{36}$, so we take 1 from 48 and change it to 36*ths* and unite it with $\frac{8}{36}$. Our minuend is now $47\frac{44}{36}$.

Subtract:

$$\begin{array}{llllllllll}
\textbf{8.} & 64\frac{3}{4} & \textbf{9.} & 52\frac{1}{5} & \textbf{10.} & 42\frac{4}{9} & \textbf{11.} & 75\frac{1}{3} & \textbf{12.} & 90\frac{2}{5} \\
 & \underline{39\frac{2}{3}} & & \underline{27\frac{2}{3}} & & \underline{25\frac{5}{6}} & & \underline{46\frac{11}{20}} & & \underline{29\frac{7}{8}}
\end{array}$$

$$\begin{array}{llllllllll}
\textbf{13.} & 79\frac{5}{12} & \textbf{14.} & 51\frac{1}{4} & \textbf{15.} & 21\frac{1}{16} & \textbf{16.} & 81\frac{3}{7} & \textbf{17.} & 53\frac{1}{2} \\
 & \underline{14\frac{7}{8}} & & \underline{36\frac{5}{18}} & & \underline{17\frac{7}{12}} & & \underline{28\frac{4}{5}} & & \underline{25\frac{14}{15}}
\end{array}$$

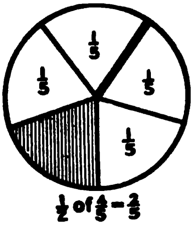
18. A girl at the silk counter sold the following quantities of silk: $3\frac{3}{4}$ yd., $7\frac{1}{8}$ yd., $\frac{3}{4}$ yd., $1\frac{1}{3}$ yd. How many yards did she sell?

19. At the ribbon counter the following quantities were sold: $2\frac{1}{3}$ yd., $5\frac{3}{4}$ yd., $4\frac{7}{8}$ yd., $6\frac{1}{2}$ yd., $2\frac{2}{3}$ yd. How many yards of ribbon were sold?

20. How many more yards of ribbon were sold than of silk?

An **integer** is a whole number. It is also called an integral number.

Divide $\frac{4}{5}$ by 2.



This means find $\frac{1}{2}$ of $\frac{4}{5}$. Show me $\frac{4}{5}$ in your fractional disks. Divide them into two equal parts. In each part there are how many fifths?

$\frac{4}{5} \div 2 = \frac{4 \div 2}{5} = \frac{2}{5}$.

Learn: To divide a fraction by an integer, divide the numerator of the fraction by the integer.

Divide:

1. $\frac{3}{4} \div 3$
2. $\frac{9}{5} \div 3$
3. $\frac{8}{12} \div 4$
4. $\frac{12}{3} \div 6$
5. $\frac{18}{8} \div 9$
6. $\frac{15}{4} \div 5$
7. $\frac{6}{7} \div 6$
8. $\frac{24}{7} \div 12$
9. $\frac{8}{11} \div 4$
10. $\frac{12}{13} \div 6$
11. $\frac{15}{6} \div 3$
12. $\frac{28}{8} \div 4$
13. $\frac{18}{19} \div 6$
14. $\frac{10}{12} \div 5$
15. $\frac{27}{5} \div 9$
16. $\frac{44}{3} \div 11$

Change mixed numbers to improper fractions before dividing.

17. $6\frac{2}{3} \div 4$
18. $8\frac{1}{3} \div 5$
19. $6\frac{3}{4} \div 9$
20. $11\frac{1}{5} \div 8$
21. $8\frac{3}{4} \div 5$
22. $5\frac{5}{8} \div 9$
23. $8\frac{3}{4} \div 7$
24. $3\frac{3}{7} \div 6$
25. $4\frac{2}{3} \div 7$
26. $9\frac{3}{8} \div 15$
27. $10\frac{1}{2} \div 7$
28. $9\frac{1}{3} \div 4$
29. $2\frac{2}{7} \div 8$
30. $5\frac{1}{4} \div 3$
31. $8\frac{3}{4} \div 5$
32. $3\frac{3}{5} \div 6$

33. $\frac{5}{8}$ lb. of shot were equally divided among 5 boys. What part of a pound did each boy have? How many ounces did each boy have?

34. If 3 lb. of butter cost \$$\frac{9}{10}$, 1 lb. will cost what part of \$1? How many cents will each pound cost?

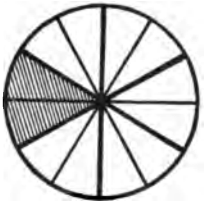
35. $\frac{6}{7}$ of a piece of work can be done in 3 days. What part of it can be done in 1 day?

36. Stuart earned \$$8\frac{3}{4}$ in 5 days. How much did he earn a day?

37. A boy ran $\frac{8}{15}$ of a mile in 4 min. What part of a mile did he run in 1 minute?

38. If 9 histories cost \$$6\frac{3}{4}$, what is the price of 1 history?

Divide $\frac{5}{6}$ by 2.



$\frac{1}{2}$ of $\frac{5}{6} = \frac{5}{12}$

Show me 5 sixths in the fractional disks. What change must you make before you can divide them into 2 equal parts? $\frac{5}{6} = -$ 12ths. $\frac{1}{2}$ of $\frac{10}{12} = \frac{5}{12}$.

$\frac{5}{6 \times 2} = \frac{5}{12}$. In dividing a fraction by an integer it is sometimes better to multiply the denominator of the fraction by the integer.

Learn: To divide a fraction by an integer,
a. Divide the numerator of the fraction by the integer
or, *b. Multiply the denominator of the fraction by the integer.*

ORAL EXERCISES.

1. $\frac{3}{4} \div 4$ 2. $\frac{2}{3} \div 3$ 3. $\frac{5}{6} \div 3$ 4. $\frac{3}{4} \div 5$
5. $\frac{9}{7} \div 2$ 6. $2\frac{1}{2} \div 5$ 7. $2 \div 3\frac{1}{3}$ 8. $4\frac{1}{2} \div 5$

WRITTEN EXERCISES.

A. Divide $35\frac{1}{3}$ by 3.

B. Divide $123\frac{1}{3}$ by 16.

A. $3\overline{)35\frac{1}{3}}$ with quotient $11\frac{7}{9}$

3 is contained in $35\frac{1}{3}$, 11 times and $2\frac{1}{3}$ remainder. $2\frac{1}{3} = \frac{7}{3}$. $\frac{7}{3} \div 3 = \frac{7}{9}$.

When the integral divisor is small, divide without changing the mixed number to an improper fraction.

B. $123\frac{1}{3} = \frac{370}{3}$.

$$\frac{370}{3} \div 16 = \frac{\overset{185}{\cancel{370}}}{3 \times \underset{8}{\cancel{16}}} = \frac{185}{24} = 7\frac{17}{24}.$$

Cancel whenever possible.

We have learned that dividing both numerator and denominator of a fraction by the same number does not change its value. Crossing out or canceling equal factors from both terms is called **cancellation.**

In B we canceled the 2 in 370 and in 16. Use cancellation freely whenever possible in fractions, as it shortens the work.

Divide:

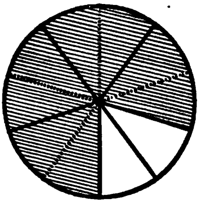
9. $178\frac{3}{4}$ by 5 **10.** $257\frac{2}{3}$ by 4 **11.** $218\frac{4}{7}$ by 6
12. $672\frac{2}{3}$ by 18 **13.** $173\frac{1}{2}$ by 24 **14.** $245\frac{3}{4}$ by 16

15. The area of a rectangular figure is $1747\frac{1}{3}$ sq. ft. It is 24 ft. wide. How long is it?

16. If you ride a distance of $4\frac{1}{4}$ miles in going 17 times round a bicycle track, what is the distance round the track?

LESSON 47 *ORAL. TO FIND A FRACTIONAL PART OF A FRACTION.*

To find a fractional part of a fraction is commonly called **multiplying a fraction by a fraction.**



$\frac{1}{2} \times \frac{1}{5} = \frac{1}{10}$

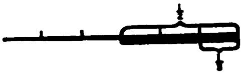
1. Find $\frac{1}{2}$ of $\frac{1}{5}$.

Take your fractional disks. Show me $\frac{1}{5}$. To find $\frac{1}{2}$ of $\frac{1}{5}$, the $\frac{1}{5}$ must be changed to——10ths.

$\frac{1}{2}$ of $\frac{2}{10} = \frac{1}{10}$.

2. Mary had $\frac{1}{2}$ of a yard of cloth, and used $\frac{1}{3}$ of it How much of a yard did she use?

The line represents 1 yard. The broad part represents the $\frac{1}{2}$ that Mary had. She used $\frac{1}{3}$ of this. Her part is divided into thirds, and the third that she used is indicated. If we divide the whole yard into pieces of the same size we shall have 6 of them; so that the part she used is $\frac{1}{6}$ of the whole yard.



3. Multiply $\frac{2}{3}$ by $\frac{3}{4}$.

A $\frac{1}{3}$ of $\frac{3}{4} = \frac{1}{4}$

$\frac{2}{3} = 2 \times \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$

B. $\frac{2}{3} \times \frac{3}{4} = \frac{2 \times 3}{3 \times 4} = \frac{6}{12} = \frac{1}{2}$

This means find $\frac{2}{3}$ of $\frac{3}{4}$. We first find $\frac{1}{3}$ of $\frac{3}{4}$, which is $\frac{1}{4}$. $\frac{2}{3}$ will be 2 x $\frac{1}{4}$, which are $\frac{2}{4}$ or $\frac{1}{2}$.

We get the same result by multiplying the numerators and the denominators together.

Learn: Multiply the numerators together for a new numerator and the denominators for a new denominator, and reduce the resulting fraction to its lowest terms.

4. $\frac{1}{2} \times \frac{1}{4}$. In examples like this the sign × is read "*of,*" thus $\frac{1}{2}$ of $\frac{1}{4} = \frac{1}{8}$.

Give products:

5. $\frac{1}{2} \times \frac{1}{2}$ **6.** $\frac{1}{2} \times \frac{1}{3}$ **7.** $\frac{1}{2} \times \frac{2}{3}$ **8.** $\frac{1}{2} \times \frac{1}{4}$
9. $\frac{1}{2} \times \frac{3}{4}$ **10.** $\frac{1}{3} \times \frac{1}{3}$ **11.** $\frac{1}{3} \times \frac{1}{4}$ **12.** $\frac{1}{3} \times \frac{3}{4}$
13. $\frac{1}{2} \times \frac{1}{5}$ **14.** $\frac{1}{2} \times \frac{2}{5}$ **15.** $\frac{1}{3} \times \frac{1}{5}$ **16.** $\frac{1}{2} \times \frac{3}{5}$
17. $\frac{1}{3} \times \frac{2}{5}$ **18.** $\frac{1}{2} \times \frac{4}{5}$ **19.** $\frac{1}{3} \times \frac{3}{5}$ **20.** $\frac{2}{3} \times \frac{1}{3}$
21. $\frac{2}{3} \times \frac{3}{4}$ **22.** $\frac{2}{3} \times \frac{2}{5}$ **23.** $\frac{3}{4} \times \frac{3}{5}$ **24.** $\frac{2}{3} \times \frac{3}{5}$

A. Multiply $86\frac{2}{3}$ by 15.

$$\begin{array}{r} 86\frac{2}{3} \\ 15 \\ \hline 10 = 15\times\frac{2}{3} \\ 430 = 5\times 86 \\ 86 = 10\times 86 \\ \hline 1300 = 15\times 86\frac{2}{3} \end{array}$$

B. Multiply 86 by $15\frac{2}{3}$.

$$\begin{array}{r} 86 \\ 15\frac{2}{3} \\ 3\overline{)172} \\ \hline 57\frac{1}{3} = \frac{2}{3}\times 86 \\ 430 = 5\times 86 \\ 86 = 10\times 86 \\ \hline 1347 = 15\frac{2}{3}\times 86 \end{array}$$

C. Multiply $8\frac{4}{5}\times 5\frac{1}{4}$.

$8\frac{4}{5} = \frac{44}{5}$. $5\frac{1}{4} = \frac{21}{4}$.

$\frac{\overset{11}{\cancel{44}}}{5}\times\frac{21}{\cancel{4}} = \frac{231}{5} = 46\frac{1}{5}$.

D. Multiply $86\frac{3}{4}$ by $24\frac{1}{2}$.

$$\begin{array}{r} 86\frac{3}{4} \\ 24\frac{1}{2} \\ \hline \frac{3}{8} = \frac{1}{2}\times\frac{3}{4} \\ 43 = \frac{1}{2}\times 86 \\ 18 = 24\times\frac{3}{4} \\ 2064 = 24\times 86 \\ \hline 2125\frac{3}{8} = 24\frac{1}{2}\times 86\frac{3}{4} \end{array}$$

Remembering previous instruction the above solutions should be sufficiently clear without further explanation.

Find the product of:

1. $5\frac{3}{4}\times 4\frac{2}{5}$

2. $4\frac{2}{3}\times 3\frac{1}{2}$

3. $16\frac{1}{2}\times 4\frac{3}{5}$

4. $6\frac{2}{3}\times 3\frac{1}{3}$

5. $8\frac{2}{3}\times 6\frac{2}{7}$

6. $6\frac{3}{4}\times 5\frac{7}{8}$

7. $20\frac{1}{2}\times 32\frac{1}{5}$

8. $27\frac{1}{5}\times 25\frac{1}{3}$

9. $15\frac{2}{3}\times 15\frac{2}{3}$

10. $42\frac{1}{3}\times 66\frac{5}{6}$

11. $24\frac{1}{2}\times 30\frac{5}{8}$

12. $15\frac{1}{4}\times 20\frac{2}{3}$

13. $42\frac{3}{8}\times 72\frac{1}{3}$

14. $30\frac{1}{2}\times 22\frac{2}{5}$

15. $24\frac{1}{7}\times 28\frac{1}{4}$

16. $15\frac{2}{5}\times 35$

17. $79\frac{3}{4}\times 48$

18. $86\frac{5}{8}\times 16$

19. $48\times 6\frac{1}{3}$

20. $96\times 16\frac{2}{3}$

21. $88\times 15\frac{3}{4}$

22. $75\frac{1}{3}\times 24\frac{1}{5}$

23. $16\frac{7}{8}\times 32\frac{3}{4}$

24. $78\frac{3}{4}\times 83\frac{1}{3}$

25. $18\frac{1}{2}\times 16\frac{1}{3}$

26. $20\frac{1}{3}\times 24\frac{1}{4}$

27. $36\frac{1}{5}\times 25\frac{5}{6}$

28. $21\frac{1}{6}\times 36\frac{1}{7}$

29. $15\frac{1}{2}\times 12\frac{3}{5}$

30. $18\frac{1}{4}\times 24\frac{1}{3}$

31. $72\frac{1}{2}\times 12\frac{1}{2}$

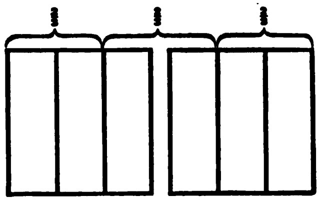
32. $15\frac{1}{3}\times 15\frac{1}{3}$

33. $16\frac{1}{4}\times 16\frac{1}{4}$

Find the cost of:

1. $424\frac{1}{8}$ lb. of starch at $9\frac{3}{4}$¢ a pound.
2. $88\frac{3}{4}$ bu. of wheat at $88\frac{1}{2}$¢ a bushel.
3. $48\frac{5}{8}$ tons of coal at \$$6\frac{3}{4}$ a ton.
4. $24\frac{1}{2}$ gal. of oil at $12\frac{1}{2}$¢ a gallon.
5. $64\frac{1}{2}$ bbl. of flour at \$$6\frac{3}{4}$ a barrel.
6. $15\frac{3}{4}$ lb. of coffee at $33\frac{1}{3}$¢ a pound.
7. $3\frac{5}{8}$ bu. of apples at \$$\frac{5}{8}$ a bushel.
8. $16\frac{2}{3}$ tons of hay at \$$16\frac{3}{4}$ a ton.
9. $15\frac{7}{8}$ bbl. of flour at \$$6\frac{2}{5}$ a barrel.
10. $8\frac{2}{3}$ yd. of cloth at \$$2\frac{1}{4}$ a yard.
11. $25\frac{3}{4}$ cd. of wood at \$$4\frac{3}{5}$ a cord.
12. $52\frac{1}{2}$ bu. of wheat at \$$.62\frac{1}{2}$ a bushel.
13. Find the area of the top of a table $8\frac{1}{2}$ ft. by $4\frac{1}{2}$ ft.
14. Find the area of a blackboard $32\frac{1}{4}$ ft. by $3\frac{1}{2}$ ft.
15. Find the area of an oilcloth $4\frac{1}{2}$ ft. by $16\frac{3}{4}$ ft.
16. Find the area of a rectangular field $36\frac{1}{4}$ rd. by $40\frac{2}{3}$ rd.
17. Find the area of a rectangular field $75\frac{3}{4}$ rd. by $32\frac{2}{5}$ rd.
18. Find the area of a rectangular field $80\frac{5}{6}$ rd. by $36\frac{4}{5}$ rd.
19. Find the area of a rectangular field $70\frac{5}{12}$ rd. by $96\frac{3}{10}$ rd.
20. Find the area of a rectangular field $48\frac{3}{5}$ rd. by $50\frac{5}{6}$ rd.
21. At \$$15\frac{3}{4}$ a ton, how much will $13\frac{3}{4}$ tons cost?
22. At \$$1\frac{1}{4}$ a yard, how much will $17\frac{2}{3}$ yd. cost?
23. Find the value of $25\frac{1}{4}$ bu. of oats at $33\frac{1}{3}$¢ a bushel.
24. Find the value of $27\frac{1}{2}$ lb. of beef at $16\frac{2}{3}$¢ a pound.
25. Find the value of $34\frac{2}{3}$ yd. of carpet at $66\frac{2}{3}$¢ a yard.
26. Multiply $26\frac{5}{8}$ by $9\frac{1}{3}$.
27. Multiply $4\frac{1}{2}$ by $3\frac{2}{5}$. Find $\frac{2}{3}$ of the product.
28. Find the cost of $19\frac{2}{3}$ yd. of cloth at $16\frac{1}{2}$¢ a yard.
29. Find the product of $36\frac{2}{3}$ and $24\frac{5}{6}$.
30. Find the value of $27\frac{1}{2}$ tons of coal at \$$5\frac{3}{4}$ a ton.

Divide 2 squares by $\frac{2}{3}$ of a square.



$2 \div \frac{2}{3} = 3$

This means how many times can you take $\frac{2}{3}$ of a square away from 2 whole squares. Into how many thirds are the 2 squares divided? How many times can you take $\frac{2}{3}$ from $\frac{6}{3}$?

Divide 21 by $\frac{3}{4}$.
$21 = \frac{84}{4}$.
$\frac{84}{4} \div \frac{3}{4} = 84 \div 3 = 28$

Change the integer to a fraction whose denominator is the same as that of the divisor. $21 = \frac{84}{4}$. $\frac{84}{4}$ and $\frac{3}{4}$ being like fractions are divided like integers. $84 \div 3 = 28$.

Learn: To divide an integer by a fraction, change the integer to a fraction whose denominator is the same as that of the divisor, then divide the numerators.

Divide:

1. 12 by $\frac{3}{4}$
2. 7 by $\frac{2}{3}$
3. 8 by $\frac{4}{5}$
4. 10 by $\frac{2}{3}$
5. 6 by $\frac{3}{8}$
6. 9 by $\frac{3}{8}$
7. 30 by $\frac{3}{4}$
8. 55 by $\frac{5}{8}$
9. 15 by $\frac{3}{5}$
10. 16 by $\frac{2}{3}$
11. 20 by $\frac{4}{5}$
12. 21 by $\frac{3}{7}$

Change mixed numbers in your divisors to improper fractions.

13. 10 by $1\frac{2}{3}$
14. 14 by $2\frac{1}{3}$
15. 42 by $4\frac{1}{5}$
16. 90 by $6\frac{3}{7}$
17. 54 by $10\frac{4}{5}$
18. 22 by $5\frac{1}{2}$
19. 30 by $3\frac{3}{4}$
20. 51 by $2\frac{3}{7}$
21. 57 by $6\frac{1}{3}$
22. 76 by $4\frac{2}{3}$
23. 36 by $3\frac{3}{5}$
24. 45 by $4\frac{1}{2}$

25. If 1 block of patchwork takes $\frac{3}{8}$ of a square yard, how many blocks can be cut from 6 square yards?

26. In making a cake Grace used $1\frac{3}{4}$ cups of flour. How many cakes can she make with 14 cups of flour?

27. Alice used $1\frac{1}{2}$ lb. of sugar each time she made fudge. How many times can she make fudge with $1 worth (18 lb.) of sugar?

28. If a blacksmith can shoe a horse in $\frac{4}{5}$ of an hour, how many horses can he shoe in 8 hours?

Divide $\frac{2}{3}$ by $\frac{3}{4}$.

A. $\frac{2}{3}=\frac{8}{12}$.
$\frac{3}{4}=\frac{9}{12}$.
$\frac{8}{12}\div\frac{9}{12}=8\div9=\frac{8}{9}$.

Change both fractions to a common denominator. Then divide as in Lesson 50.

This method is recommended, being the same as that taught for addition and subtraction of fractions.

B. $\frac{2}{3}\div\frac{3}{4}=$
$\frac{2}{3}\times\frac{4}{3}=\frac{8}{9}$.

Since $1\div\frac{3}{4}$ is $\frac{4}{3}$, $\frac{2}{3}\div\frac{3}{4}$ is $\frac{2}{3}$ of $\frac{4}{3}$ or $\frac{2}{3}\times\frac{4}{3}$. Multiplying as in Lesson 47, the result is $\frac{8}{9}$.

Learn: Change the fractions to a common denominator, and divide the numerator of the dividend by the numerator of the divisor, or multiply by the reciprocal of the divisor.

ORAL EXERCISES.

1. $\frac{9}{10}\div\frac{2}{5}$ **2.** $\frac{3}{14}\div\frac{2}{7}$ **3.** $\frac{8}{9}\div\frac{2}{3}$ **4.** $\frac{5}{6}\div\frac{7}{12}$
5. $\frac{4}{12}\div\frac{3}{4}$ **6.** $\frac{3}{8}\div\frac{3}{4}$ **7.** $\frac{3}{4}\div\frac{5}{8}$ **8.** $\frac{3}{7}\div\frac{2}{14}$
9. $\frac{7}{8}\div\frac{3}{4}$ **10.** $\frac{5}{6}\div\frac{2}{3}$ **11.** $\frac{9}{10}\div\frac{3}{5}$ **12.** $\frac{7}{12}\div\frac{1}{3}$
13. $\frac{7}{10}\div\frac{1}{2}$ **14.** $\frac{3}{4}\div\frac{2}{3}$ **15.** $\frac{5}{8}\div\frac{1}{4}$ **16.** $\frac{5}{12}\div\frac{2}{3}$
17. $\frac{3}{16}\div\frac{1}{8}$ **18.** $\frac{9}{10}\div\frac{1}{5}$ **19.** $\frac{12}{14}\div\frac{2}{7}$ **20.** $\frac{3}{4}\div\frac{1}{2}$
21. $\frac{5}{6}\div\frac{1}{2}$ **22.** $\frac{4}{5}\div\frac{3}{10}$ **23.** $\frac{9}{12}\div\frac{1}{3}$ **24.** $\frac{4}{5}\div\frac{2}{3}$

WRITTEN EXERCISES.

Divide:

25. $\frac{15}{24}$ by $\frac{5}{6}$ **26.** $\frac{12}{55}$ by $\frac{9}{11}$ **27.** $\frac{3}{4}$ by $\frac{9}{16}$ **28.** $\frac{4}{11}$ by $\frac{3}{5}$
29. $\frac{16}{27}$ by $\frac{8}{9}$ **30.** $\frac{23}{6}$ by $\frac{45}{9}$ **31.** $\frac{4}{7}$ by $\frac{3}{5}$ **32.** $\frac{17}{24}$ by $\frac{5}{6}$

Note: *Mixed numbers should first be changed to improper fractions.*

33. $4\frac{3}{5}$ by $6\frac{9}{10}$ **34.** $84\frac{3}{8}$ by $4\frac{1}{2}$ **35.** $28\frac{4}{5}$ by $4\frac{1}{2}$
36. $4\frac{3}{8}$ by $1\frac{3}{8}$ **37.** $8\frac{4}{5}$ by $12\frac{2}{3}$ **38.** $45\frac{5}{8}$ by $12\frac{1}{2}$
39. $16\frac{3}{4}$ by $12\frac{1}{2}$ **40.** $3\frac{5}{8}$ by $6\frac{3}{4}$ **41.** $14\frac{3}{8}$ by $17\frac{1}{2}$
42. $9\frac{1}{14}$ by $32\frac{5}{7}$ **43.** $24\frac{1}{2}$ by $2\frac{1}{3}$ **44.** $9\frac{3}{5}$ by $5\frac{5}{6}$
45. $5\frac{3}{8}$ by $7\frac{5}{6}$ **46.** $2\frac{1}{3}$ by $5\frac{1}{4}$ **47.** $6\frac{2}{3}$ by $4\frac{4}{9}$

1. If 80 cents are paid for $\frac{5}{6}$ of a basket of peaches, what is the cost of $\frac{1}{2}$ of a basket?

(Hint. $\frac{1}{2}$=how many sixths?)

2. I sold a horse for $48, which was $\frac{8}{9}$ of what he cost me. What did he cost me?

3. George sold a kite for $\frac{3}{5}$ of what he paid for it, and lost 8 cents. What part did he lose? What did the kite cost?

4. 8 is $\frac{2}{5}$ of what number?

5. The difference between $\frac{4}{5}$ and $\frac{9}{10}$ of a number is 5. What is the number?

6. Change to fractions having smaller terms: $\frac{18}{30}$, $\frac{12}{28}$, $\frac{9}{27}$, $\frac{21}{24}$, $\frac{20}{36}$, $\frac{12}{24}$, $\frac{16}{36}$, $\frac{24}{40}$, $\frac{14}{42}$, $\frac{40}{48}$, $\frac{20}{50}$, $\frac{36}{60}$.

7. What is the relation of 4 to 32? Of 9 to 27?

8. A farmer sold a cow for $36. If this was $\frac{6}{5}$ of the cost of the cow, what was her cost?

9. What is $\frac{1}{2}$ of $\frac{1}{4}$? $\frac{1}{2}$ of $\frac{1}{5}$? $\frac{1}{2}$ of $\frac{1}{6}$? $\frac{1}{3}$ of $\frac{1}{2}$? $\frac{1}{3}$ of $\frac{1}{4}$?

10. What is $\frac{1}{3}$ of $\frac{1}{6}$? $\frac{1}{4}$ of $\frac{1}{5}$? $\frac{1}{5}$ of $\frac{1}{3}$? $\frac{1}{5}$ of $\frac{1}{6}$? $\frac{1}{6}$ of $\frac{1}{2}$?

11. What is $\frac{1}{3}$ of $\frac{5}{6}$? $\frac{5}{6}$ of $\frac{2}{3}$? $\frac{4}{5}$ of $\frac{2}{7}$? $\frac{1}{7}$ of $\frac{2}{3}$? $\frac{3}{5}$ of $\frac{3}{8}$?

12. The difference between $\frac{1}{2}$ and $\frac{1}{4}$ of a pile of apples is 8 quarts. How many quarts are there in the pile?

13. If $\frac{1}{3}$ of a yard of silk costs $\$1\frac{1}{2}$, what will 1 yd. cost?

14. A grocer sold eggs at 20¢ a dozen, which was $\frac{5}{4}$ of what they cost him. What did they cost him?

15. $6\frac{1}{4}$ is $\frac{5}{8}$ of what number?

16. $4\frac{1}{2}$ is $\frac{3}{10}$ of what number?

17. A farmer sold 6 pigs for $24, which was $\frac{4}{5}$ of what he paid for them. What did he pay for one?

18. If 9 bottles of ink cost $\$2\frac{1}{4}$, what will 5 bottles cost?

19. If 6 lb. of lead cost $\$1\frac{1}{5}$, what will 7 lb. cost?

20. Into how many equal parts is the unit divided in the fraction $\frac{5}{8}$? How many of the parts are taken?

21. $3 divided equally among 4 persons gives what part of $1 to each?

Change to lowest terms:

1. $\frac{16}{20}$ 2. $\frac{21}{24}$ 3. $\frac{54}{63}$ 4. $\frac{56}{72}$ 5. $\frac{36}{44}$ 6. $\frac{75}{125}$

Change to higher terms:

7. $\frac{3}{4}$, $\frac{5}{6}$, $\frac{3}{8}$, $\frac{5}{12}$ to 24ths.

8. $\frac{2}{3}$, $\frac{1}{4}$, $\frac{5}{6}$, $\frac{7}{9}$, $\frac{7}{12}$ to 36ths.

Change to similar fractions, or to fractions having the same denominator:

9. $\frac{3}{16}$, $\frac{1}{4}$, $\frac{7}{8}$ 10. $\frac{4}{9}$, $\frac{15}{18}$, $\frac{4}{36}$ 11. $\frac{2}{5}$, $\frac{9}{10}$, $\frac{7}{15}$

12. $\frac{3}{4}$, $\frac{5}{8}$, $\frac{1}{6}$ 13. $\frac{2}{7}$, $\frac{3}{14}$, $\frac{5}{21}$ 14. $\frac{7}{12}$, $\frac{3}{8}$, $\frac{9}{24}$

Change to improper fractions:

15. $6\frac{3}{4}$, $9\frac{1}{5}$, $4\frac{5}{6}$, $9\frac{3}{7}$, $12\frac{3}{8}$, $15\frac{7}{9}$, $91\frac{9}{10}$, $21\frac{5}{11}$, $74\frac{9}{14}$.

Change to mixed numbers:

16. $\frac{175}{12}$, $\frac{235}{9}$, $\frac{177}{24}$, $\frac{376}{25}$, $\frac{82}{9}$, $\frac{91}{4}$, $\frac{46}{7}$, $\frac{61}{15}$, $\frac{85}{12}$.

Add:

17. $\frac{2}{3}+\frac{3}{4}+\frac{5}{6}$ 18. $\frac{2}{3}+\frac{5}{6}+\frac{7}{12}$ 19. $\frac{3}{5}+\frac{7}{10}+\frac{9}{20}$

Subtract:

20. $\frac{2}{3}-\frac{1}{4}$ 21. $\frac{5}{6}-\frac{2}{3}$ 22. $\frac{4}{5}-\frac{3}{4}$ 23. $16\frac{1}{4}-12\frac{1}{5}$

Multiply:

24. $\frac{2}{3}$ by 6 25. $\frac{3}{4}$ by 8 26. $\frac{7}{8}$ by 16 27. $6\frac{1}{3}$ by 9

28. 21 by $\frac{2}{3}$ 29. 24 by $\frac{5}{6}$ 30. $4\frac{3}{8}$ by 6 31. 84 by $\frac{2}{7}$

32. $3\frac{1}{3}$ by $\frac{3}{4}$ 33. $\frac{6}{7}$ by $\frac{8}{9}$ 34. $5\frac{2}{3}$ by $4\frac{1}{2}$ 35. $8\frac{2}{3}$ by $6\frac{1}{4}$

Divide:

36. $18\frac{2}{3}$ by 6 37. $14\frac{1}{3}$ by 4 38. $11\frac{2}{3}$ by 7 39. $32\frac{1}{4}$ by 4

40. 18 by $\frac{2}{3}$ 41. 36 by $\frac{3}{5}$ 42. 21 by $\frac{3}{7}$ 43. 16 by $6\frac{2}{3}$

44. $\frac{6}{7}$ by $\frac{3}{4}$ 45. $\frac{3}{4}$ by $\frac{2}{5}$ 46. $\frac{8}{9}$ by $\frac{2}{3}$ 47. $2\frac{1}{2}$ by $\frac{5}{6}$

48. If $5\frac{1}{2}$ tons of coal are worth \$$35\frac{3}{4}$, how much is 1 ton worth?

49. From a barrel of oil containing $31\frac{1}{2}$ gal., the following quantities were sold: 5 gal., $3\frac{1}{2}$ gal., 6 gal., $4\frac{1}{2}$ gal., $5\frac{1}{2}$ gal. State the amount left in the barrel after each sale.

50. A grocer had 2 chests of tea, one containing $35\frac{5}{8}$ lb., and the other $42\frac{8}{16}$ lb. How many pounds of tea did the grocer have?

1. James receives $8 a week, and his sister ¾ as much. How much do both receive in a week?

2. A girl has to practice an hour a day. If she practices 20 min. before school, 20 min. at noon, how many minutes must she practice after school?

3. If George earns $42 in 7 weeks, how long will it take him to earn $72?

4. I have an album which has 20 pages, and 4 pictures on a page. How many pictures does it hold?

5. I bought a pound of maple sugar, but have given away 12 oz. How many ounces have I left?

6. Henry measured a room with a yard stick, and found it to be 5⅓ times the length of the stick. How many feet long was the room?

7. If in shipping 6 doz. eggs, 1½ doz. are broken, how many eggs are not broken?

8. If 6 peaches fill a quart measure, how many of the same size will fill a peck measure?

9. How many pints are there in ¼ of a gallon? In ½ of a gallon?

10. How many inch cubes can be laid together, side by side, on a square foot of surface? How many layers could you put on top of this to equal 1 foot in height? What form would you have?

11. How many cents are there in ½ of a dollar? In ¼ of a dollar? In ⅕ of a dollar? In ¾ of a dollar?

12. What per cent of anything is ½ of it? ¼ of it? ⅕ of it? ¾ of it?

13. What part of a dollar is 50 cents? 25 cents? 20 cents? 75 cents?

14. What part of anything is 50% of it? 25% of it? 20%? 75%?

15. State two ways of multiplying a fraction by an integer.

1. A man had $7200. He paid $4000 for a house, $650 for repairs, and $464.75 for furniture. How much money had he left?

2. A man sold 56 yards of cloth for $128, gaining $16. What did it cost him a yard?

3. If 23 carriages cost $4025, what are 80 carriages worth?

4. A farmer's wife sold a storekeeper 18 doz. eggs at 14¢ a dozen, and 35 lb. butter at 21¢ a pound. How much did the storekeeper owe her?

5. A horse costs $265, a carriage $235, and a hack 3 times as much as both. What do they all cost?

6. By selling 13 acres of land for $583, I lost $54. What was the cost an acre?

7. How many feet of moulding will be required to go round a room, if it is 35 ft. long and 30 feet wide?

8. Add $\frac{2}{4}$, $4\frac{1}{2}$, $5\frac{2}{8}$, $10\frac{3}{4}$.

9. At $7.86 a barrel, what will 18 barrels of flour cost?

10. I bought a tract of land, and cut it up into 28 building lots, which I sold at $379 each, thereby gaining $1428. What was the cost of the land?

11. Mr. Smith bought 19 cows for $532. The cost of feeding them was $7 a head. He sold them for $798. How much did he gain or lose?

12. What are 7432 qt. of berries worth at 60¢ a peck?

13. A man deposited in the bank $30 a month for 10 months, and $25 a month for the other months of the year. How many dollars did he deposit during the year?

14. What will a yard of silk cost at the rate of $25.60 for 16 yards? What will $\frac{1}{8}$ of a yard cost?

15. A man bought a horse for $120 and another for $75. He sold both horses for $150. How many dollars did he lose?

16. The floor of a room contains 216 square feet. If one side is 4 yards long, how many yards long is the other side?

17. 70 doz. cans of corn at $.16$\frac{2}{3}$ each will cost $——.

1. George had 75 apples, and gave away 20% of them. How many had he left?

2. A grocer lost $100 on a cargo of fruit, which was 50% of the cost. Find the cost.

3. If 6 oranges cost 24 cents, what will 8 oranges cost at the same rate?

4. If 9 pears cost 27 cents, what will 12 pears cost at the same rate?

5. If 3 bbl. of flour are worth $18, what are 7 bbl. worth?

6. If 6 tubs of butter cost $42, what will 4 tubs cost?

7. If 8 yd. of silk cost $32, what will 9 yd. cost?

8. If 9 bbl. of cider cost $45, what will 4 bbl. cost?

9. How much will 60 caps cost at 33⅓¢ each?

10. At 33⅓¢ a gallon, what will 150 gallons of molasses cost?

11. A boy bought a bicycle for $15, and sold it at 33⅓% above cost. What did he receive for it?

12. If a newsboy buys papers at 2¢ each, and sells them at 3¢, what per cent of profit does he make?

13. If a boy buys papers at 1¢ each, and sells them at 2¢, what per cent of profit does he make?

14. What will my board amount to in 12 weeks, if I pay at the rate of $35 for 7 weeks?

15. If 4 men can do a piece of work in 6 days, how long will it take 8 men to do the same work?

16. How many cubic feet are there in a rectangular block of granite 4 ft. long, 3 ft. wide, and 2 ft. thick?

17. How many square rods are there in a garden 4 rd. long and 3 rd. wide?

18. If 10 bbl. of beef cost $70, what will 8 bbl. cost?

19. What is ½ of ½ of a square? Prove it by a drawing.

20. What is ⅓ of ¼? Prove it by a drawing.

21. If you know how much ⅔ of a number is, how can you find ⅓ of it? How can you find the whole number?

1. There were 48 present in a class on Monday, 52 on Tuesday, 45 on Wednesday, 47 on Thursday, 38 on Friday. What was the average number present on each day?

$$\begin{array}{r}48\\52\\45\\47\\\underline{38}\\5\overline{)230}\\\hline 46\end{array}$$

By adding the numbers present on each day, we find there were 230 pupils present for the 5 days. If there were 230 pupils present in 5 days, it would be the same as 46 pupils for each one of the five days.

2. A lady bought one pound of tea for 55 cents, and one pound for 75 cents. What was the average price a pound?

3. If there are 280 pupils in school Monday, 295 Tuesday, 312 Wednesday, 303 Thursday, and 275 Friday, what is the average attendance for the week?

4. What is the average price of 6 horses costing $135, $140, $150, $175, $250, $266 respectively.

5. If the attendance of pupils in your room last week was as follows: Monday 44, Tuesday 41, Wednesday 45, Thursday 38, Friday 42, what was the average attendance for the week?

6. A man worked 8½ hr. Monday, 9 hr. Tuesday, 8 hr. Wednesday, 9½ hr. Thursday, 7¼ hr. Friday, and 5¾ hr. Saturday. How many hours on the average did he work each day?

7. What is the average age of four girls whose ages are 12¼ yr., 13½ yr., 14¼ yr. and 12 yr. respectively?

8. The attendance at an exposition for one week in July was as follows: Monday, 45,300, Tuesday, 46,800, Wednesday, 38,150, Thursday, 52,400, Friday, 39,100, Saturday, 71,200, and Sunday, 21,000. What was the average attendance for the week?

9. In a certain school there were enrolled last month 36 children in the kindergarten, 45 in No. 1, 47 in No. 2, 48 in No. 3, 50 in No. 4, 53 in No. 5, 56 in No. 6, 42 in No. 7, 43 in No. 8, 44 in No. 9, 46 in No. 10, and 126 in No. 11. What was the average attendance for each room?

Add:

1. 2.2	**2.** 7.25	**3.** 8.4	**4.** 6.5
3.1	5.75	3.6	2.5

5. Write as decimals of a dollar 40 cents; 20 cents; 50 cents; 25 cents; 80 cents; 75 cents.

6. Charles spent .4 of a dollar a day for 5 days. He spent \$——.

7. When butter is \$.3, 6 lb. of butter will cost \$——.

8. When 7 lb. of butter cost 21 tenths of a dollar, what will 1 lb. cost?

9. Divide 3.6 by 3. 1.6 by 2. 1.8 by 6.

10. A wire 4.8 ft. long was cut into 4 equal pieces. Each piece was —— ft. long.

11. From 4.2 take 2.1. From 10 take 3.6.

12. Each side of a square measures 3.25 in. What is its perimeter?

13. Write 17 tenths; 225 hundredths; 25 tenths.

14. $8\overline{)224 \text{ tenths}}$. $8\overline{)22.4}$.

15. 9 tenths of a dollar are —— cents. \$.3 = —— cents.

16. 60 cents = ——tenths of a dollar.

17. $\frac{1}{2}$ of a dollar is how many tenths of a dollar?

18. $\frac{1}{4}$ of a dollar is how many hundredths of a dollar?

19. How many tenths are there in 3.2? In 2.6?

20. Find $\frac{1}{3}$ of 1.5. Find $\frac{1}{3}$ of 15 tenths.

21. Find $\frac{3}{4}$ of 3.2. Find $\frac{3}{4}$ of 32 tenths.

22. Find $\frac{1}{10}$ of 30. Of 70. Of 36. Of 75. Of 100.

23. Find .1 of 20. Of 50. Of 25. Of 240. Of \$2.40.

24. $\frac{2}{10}$ is what part of $\frac{4}{10}$? .2 is what part of .4?

25. If you annex 2 zeros at the right of a decimal, what change have you made in the value of the decimal?

26. $\frac{1}{10}$ of a cent is called a *mill*. A mill is what part of a dollar?

Multiply 2.4 by .4.

A. $\left.\begin{array}{r}2.4\\ \underline{.4}\end{array}\right\} = \begin{array}{r}.24\\ \underline{4}\\ .96\end{array}$

This means find $\frac{4}{10}$ of 2.4. We first find $\frac{1}{10}$ (Lesson 34). $\frac{1}{10}$ of 2.4= .24. $\frac{4}{10}$ will be 4 x.24=.96. (Lesson 33).

B. $\begin{array}{r}2.4\\ \underline{.4}\\ .96\end{array}$

Since tenths times tenths gives hundredths, we multiply as in integers and point off two places in the product.

Learn: To multiply a decimal by a decimal: A. Move the decimal point in the multiplicand as many places to the left as there are decimals in the multiplier, then multiply as by integers. B. Multiply as by integers and point off in the product as many decimal places as there are decimal places in both multiplicand and multiplier.

Multiply:

1. $\begin{array}{r}2.5\\ \underline{.5}\end{array}$	**2.** $\begin{array}{r}46.05\\ \underline{.4}\end{array}$	**3.** $\begin{array}{r}1.6\\ \underline{.7}\end{array}$	**4.** $\begin{array}{r}3.25\\ \underline{.6}\end{array}$
5. $\begin{array}{r}5.07\\ \underline{.8}\end{array}$	**6.** $\begin{array}{r}4.8\\ \underline{.9}\end{array}$	**7.** $\begin{array}{r}16.04\\ \underline{.7}\end{array}$	**8.** $\begin{array}{r}7.25\\ \underline{.4}\end{array}$
9. $\begin{array}{r}4.03\\ \underline{.5}\end{array}$	**10.** $\begin{array}{r}8.15\\ \underline{.8}\end{array}$	**11.** $\begin{array}{r}1.7\\ \underline{.9}\end{array}$	**12.** $\begin{array}{r}2.3\\ \underline{.8}\end{array}$
13. $\begin{array}{r}6.5\\ \underline{.7}\end{array}$	**14.** $\begin{array}{r}8.9\\ \underline{6}\end{array}$	**15.** $\begin{array}{r}7.2\\ \underline{5}\end{array}$	**16.** $\begin{array}{r}1.15\\ \underline{.4}\end{array}$
17. $\begin{array}{r}2.12\\ \underline{.3}\end{array}$	**18.** $\begin{array}{r}1.18\\ \underline{.2}\end{array}$	**19.** $\begin{array}{r}4.20\\ \underline{.6}\end{array}$	**20.** $\begin{array}{r}3.05\\ \underline{.7}\end{array}$
21. $\begin{array}{r}1.05\\ \underline{.5}\end{array}$	**22.** $\begin{array}{r}2.06\\ \underline{.4}\end{array}$	**23.** $\begin{array}{r}3.07\\ \underline{.6}\end{array}$	**24.** $\begin{array}{r}4.08\\ \underline{.8}\end{array}$
25. $\begin{array}{r}5.09\\ \underline{.7}\end{array}$	**26.** $\begin{array}{r}4.22\\ \underline{.9}\end{array}$	**27.** $\begin{array}{r}5.33\\ \underline{.8}\end{array}$	**28.** $\begin{array}{r}6.44\\ \underline{.5}\end{array}$
29. $\begin{array}{r}7.55\\ \underline{.6}\end{array}$	**30.** $\begin{array}{r}8.66\\ \underline{.7}\end{array}$	**31.** $\begin{array}{r}4.35\\ \underline{.5}\end{array}$	**32.** $\begin{array}{r}1.76\\ \underline{.6}\end{array}$

Multiply 24.65 by .24.

$$\left.\begin{array}{r}24.65\\ \underline{.24}\end{array}\right\} = \begin{array}{r}.2465\\ \underline{24}\\ .9860\\ \underline{4.930}\\ 5.9160\end{array}$$

This means find $\frac{24}{100}$ of 24.65. First find $\frac{1}{100}$ by moving the point 2 places to the left. (Lesson 34.) $\frac{1}{100}$ of 24.65=.2465. 24 times .2465=5.916.

Multiply:

1. 64.06 .25	**2.** 70.30 .36	**3.** 80.04 .47	**4.** 86.65 .58
5. 70.09 .15	**6.** 30.08 .26	**7.** 80.09 .37	**8.** 68.40 .48
9. 3.94 .26	**10.** 4.58 .38	**11.** 8.60 .49	**12.** 2.45 .51
13. 60.94 .63	**14.** 70.68 .35	**15.** 90.09 .74	**16.** 16.07 .43

17. At 22¢ a yard, 14.5 yd. of cloth will cost ——.

18. What will 56.75 lb. of sugar cost at 4.5 cents a pound?

19. If a ship sails 18.8 miles an hour, how far will it sail in 10.5 hours?

20. At 26¢ a dozen, find the cost of 15.25 doz. eggs.

21. At $1.75 a day, how much will a man earn in 15.5 days?

22. At the rate of 45.75 miles an hour, how far will an express train travel in 7.25 hours?

23. How much farther did the express train travel in 7 25 hr. than an automobile that traveled 37.5 m. an hour?

24. A cubic foot of water weighs 62.5 pounds. Cast iron is 7.2 times heavier. What is the weight of a cubic foot of cast iron?

25. Pine wood is .537 times as heavy as water. Find the weight of a cubic foot of pine wood.

1. At $.06 a pound what will 15.5 lb. cost?

2. Multiply 6 thousand by 6 thousandths.

3. If a man earns $9.25 a week how much can he earn in 8.5 weeks?

4. Multiply 46.709 by 1000. Divide 276.08 by 1000.

Add:

5.	**6.**	**7.**	**8.**
9.7	8.9	2.24	6.807
1.6	6.1	3.42	3.315
3.8	5.0	9.91	6.709
6.1	3.7	9.36	8.005
0.5	1.1	7.67	6.117
1.8	8.2	9.15	0.809

Subtract:

9.	**10.**	**11.**	**12.**
16.8	8.4	169.50	98.401
9.7	6.7	83.74	89.578

Multiply:

13. .6 by .17 **14.** .9 by .84 **15.** 1.9 by 8.64 **16.** .8 by .04

17. 1.8 by .14 **18.** .9 by 1.01 **19.** .6 by .06 **20.** .8 by .08

21. If a man walks 3.75 miles an hour, how far can he walk in 6.3 hours?

22. What must I pay for 3.6 feet of land at $0.37 a foot?

23. Divide 6.51 by 7.

24. Divide 4.18 by 4.

25. What is the cost of 19.75 yards of cloth at $2.75 a yard?

26. Find the difference between .00471 and .0143.

27. Compare 4 with .4. If .4 of a ton of hay is worth $7.50, what are 4 tons worth?

28. Find the area of a rectangle, the sides of which measure 37.25 ft. and 15.5 ft.

29. How many miles does an automobile travel in 8.4 hr. if it travels at the rate of 17.5 m. an hour?

1. Divide 24 by 4. 240 by 40. 2400 by 400.

2. How do the quotients compare in the three examples?

3. We see then that *multiplying both dividend and divisor by the same number does not change the quotient.*

4. Divide 2.44 by .4.

$$\begin{array}{r} 6.1 \\ .4\overline{)2.44} = 4\overline{)24.4} \end{array}$$

Multiply both divisor and dividend by 10. (See Lesson 34.) We now divide 24.4 by 4. (Lesson 33.)

5. Moving the decimal point one place to the right in both dividend and divisor multiplies them both by 10 and does not change the quotient.

6. *Before dividing change the divisor to an integer by moving the decimal points in both dividend and divisor to the right as many places as there are decimal figures in the divisor. Place the decimal point in the quotient directly above the point in the dividend, after using the unit figure of the dividend.*

Give quotients quickly after mentally changing the decimal points:

7. $.2\overline{).4}$ **8.** $.3\overline{).9}$ **9.** $.4\overline{).8}$ **10.** $.2\overline{).6}$

11. $.2\overline{)1.2}$ **12.** $.3\overline{)1.8}$ **13.** $.4\overline{)2.4}$ **14.** $.5\overline{)1.5}$

15. $.6\overline{)3.6}$ **16.** $.4\overline{)1.64}$ **17.** $.3\overline{)1.59}$ **18.** $.7\overline{)4.97}$

19. $.02\overline{).08}$ **20.** $.07\overline{).14}$ **21.** $.09\overline{).27}$ **22.** $.08\overline{).64}$

23. $.06\overline{).54}$ **24.** $.05\overline{)45}$ **25.** $.04\overline{).36}$ **26.** $.09\overline{).81}$

27. $.7\overline{).014}$ **28.** $.6\overline{).024}$ **29.** $.9\overline{).045}$ **30.** $.8\overline{).064}$

31. Divide .126 by .6. After changing this becomes 1.26 ÷ 6. Think of 1.26 as 126 hundredths. The quotient will then be hundredths.

32. $.9\overline{).189}$ **33.** $.5\overline{).265}$ **34.** $.2\overline{).416}$ **35.** $.3\overline{).369}$

36. $.012\overline{)1.440}$ **37.** $.009\overline{).0072}$ **38.** $.008\overline{).0048}$ **39.** $.002\overline{).0246}$

40. Divide 6 by .03. This becomes 600 ÷ 3. Annexing ciphers to the integer is the same as moving the decimal point to the right. Why?

41. $.06\overline{)24}$ **42.** $.008\overline{)64}$ **43.** $.012\overline{)36}$ **44.** $.011\overline{)88}$

Divide:

1. 6.48 by .6
2. .36 by .09
3. 12.8 by 1.6
4. 9.52 by .7
5. 9.08 by .2
6. .49 by .7
7. 6.75 by .15
8. 1.44 by .06
9. .96 by .08
10. 9.52 by 4.76
11. 3.28 by .4
12. 6.4 by .08
13. .0403 by .65
14. 3.24 by .09
15. 42.602 by 8.95
16. 14.4 by .12
17. 3.268 by .76
18. 25.6 by 1.6
19. .8 by 1.6
20. .02275 by .625
21. 412.5 by .33
22. 10.8 by .09
23. 17.28 by 1.44
24. 5.2 by 6.5

Divide 31.68 by 2.4.

$$\begin{array}{r} 13.2 \\ 24\overline{)316.8} \\ \underline{24} \\ 76 \\ \underline{72} \\ 4.8 \\ \underline{4.8} \end{array}$$

Notice the position of the decimal point in the partial dividend 4.8. This point need not be written after the work is clearly understood.

Divide .012 by 3.6.

$$\begin{array}{r} .0033+ \\ 36\overline{).1200} \\ \underline{108} \\ 120 \\ \underline{108} \\ 12 \end{array}$$

After carrying the quotient to four decimal places, there is still a remainder. This fact is indicated by placing the sign + after the last quotient figure.

Divide:

25. 8.145 by 7.5
26. 7.515 by 1.875
27. 34.75 by 2.5
28. 75.002 by .006
29. .735 by 10.5
30. 2.516 by .312
31. 44.814 by .97
32. 1.0276 by .028
33. 98.4 by .024
34. 6.232 by .82
35. 20.72 by .28
36. 8.348 by 2.68
37. 3.05 by .5
38. 71.05 by .007
39. 18.03 by .003
40. .005936 by .0056
41. .03672 by .054
42. .02575 by 20.6

1. Is there any difference in value between $\frac{1}{10}$ and .1?

2. Is there any difference in value between $\frac{1}{100}$ and .01?

3. Express $\frac{2}{10}$ as a decimal. $.2=\frac{2}{10}=\frac{1}{5}$.

4. Express $\frac{5}{100}$ as a decimal. $.05=\frac{5}{100}=\frac{1}{20}$.

Learn: Decimals are changed to common fractions by expressing the denominator. The fraction should then be changed to its lowest terms.

ORAL EXERCISES.

Change to common fractions in their lowest terms:

4. .2 **5.** .25 **6.** .10 **7.** .5
8. .6 **9.** .05 **10.** .8 **11.** .15
12. .12 **13.** .3 **14.** .02 **15.** .9
16. .75 **17.** .80 **18.** .40 **19.** .90

Express 2.125 as a common fraction.

$2.125=2\ \frac{125}{1000}=2\frac{1}{8}$. An expression consisting of an integer and a decimal is a **mixed decimal.** The decimal part only is changed to a common fraction. The result is a mixed number.

Express as common fractions or mixed numbers:

20. 5.5 **21.** 3.25 **22.** 4.75 **23.** .125
24. 6.6 **25.** 4.40 **26.** 5.80 **27.** .005
28. $.12\frac{1}{2}$ **29.** $.33\frac{1}{3}$ **30.** $.66\frac{2}{3}$ **31.** 4.125

WRITTEN EXERCISES.

Express as common fractions in their lowest terms:

32. .35 **33.** .475 **34.** .245 **35.** .148
36. .412 **37.** .55 **38.** .145 **39.** .364
40. .165 **41.** 4.625 **42.** 2.375 **43.** 1.025
44. 3.875 **45.** .0625 **46.** 4.95 **47.** 2.0125
48. 8.075 **49.** 7.012 **50.** 9.675 **51.** $9.66\frac{2}{3}$

Changing common fractions to decimals.

Change $\frac{5}{8}$ to a decimal.

$$\begin{array}{r} .625 \\ 8\overline{)5.000} \end{array}$$

$\frac{5}{8}$ is an expression of division. 5 is the dividend, and 8 is the divisor. This means, then, find $\frac{1}{8}$ of 5. Since 8 is not contained in 5 units, we change 5 units to 50 tenths. 8 is contained in 50 tenths 6 tenths times, etc. See Lesson 33.

Learn: To change a common fraction to a decimal fraction, annex ciphers to the numerator and divide by the denominator.

All common fractions cannot be reduced to exact decimals. In the following examples carry the result to thousandths, in case of inexact decimals.

Change to decimals:

1. $\frac{3}{8}$
2. $\frac{1}{2}$
3. $\frac{3}{7}$
4. $\frac{7}{16}$
5. $\frac{7}{8}$
6. $\frac{3}{4}$
7. $\frac{9}{10}$
8. $\frac{4}{5}$
9. $\frac{27}{32}$
10. $\frac{36}{65}$
11. $\frac{14}{25}$
12. $\frac{13}{15}$
13. $\frac{5}{24}$
14. $\frac{15}{16}$
15. $\frac{4}{9}$
16. $\frac{5}{11}$
17. $\frac{8}{15}$
18. $\frac{2}{3}$
19. $\frac{3}{8}$
20. $\frac{5}{6}$
21. $\frac{11}{12}$
22. $\frac{3}{5}$
23. $\frac{8}{9}$
24. $\frac{5}{8}$
25. $\frac{3}{16}$
26. $\frac{3}{32}$
27. $\frac{9}{16}$
28. $\frac{7}{20}$
29. $\frac{3}{125}$
30. $\frac{5}{128}$
31. $\frac{3}{40}$
32. $\frac{7}{80}$
33. $4\frac{1}{5}$
34. $3\frac{5}{8}$
35. $7\frac{5}{8}$
36. $18\frac{3}{4}$
37. $5\frac{7}{16}$
38. $9\frac{11}{32}$
39. $3\frac{1}{3}$
40. $9\frac{2}{7}$
41. $\frac{3}{200}$
42. $\frac{156}{200}$
43. $\frac{321}{500}$
44. $\frac{19}{200}$
45. $.3\frac{1}{8}$
46. $1.4\frac{7}{8}$
47. $2.6\frac{4}{5}$
48. $4.2\frac{1}{4}$
49. $.7\frac{3}{8}$
50. $2.2\frac{3}{4}$
51. $1.4\frac{3}{16}$
52. $5.3\frac{1}{2}$
53. $.6\frac{3}{16}$
54. $5.1\frac{3}{5}$
55. $4.0\frac{5}{8}$
56. $3.0\frac{3}{32}$

CHANGING IMPORTANT FRACTIONS TO EQUIVALENT PER CENTS

There are some fractions that occur so frequently in business that we should be familiar with them in whatever form they occur, thus, $\frac{1}{2} = .5 = \$.50 = 50\%$.

Commit to memory the following table, showing many common fractions and their equivalent decimal form and their equivalent per cents.

Common Fraction.		Decimal Fraction.		Parts of $1.		Per cents.
$\frac{1}{2}$	=	.5	=	$.50	=	50%
$\frac{1}{4}$	=	.25	=	$.25	=	25%
$\frac{1}{3}$	=	$.33\frac{1}{3}$	=	$\$.33\frac{1}{3}$	=	$33\frac{1}{3}\%$
$\frac{1}{5}$	=	.2	=	$.20	=	20%
$\frac{1}{6}$	=	$.16\frac{2}{3}$	=	$\$.16\frac{2}{3}$	=	$16\frac{2}{3}\%$
$\frac{1}{8}$	=	$.12\frac{1}{2}$	=	$\$.12\frac{1}{2}$	=	$12\frac{1}{2}\%$
$\frac{1}{10}$	=	.1	=	$.10	=	10%
$\frac{3}{4}$	=	.75	=	$.75	=	75%
$\frac{2}{3}$	=	$.66\frac{2}{3}$	=	$\$.66\frac{2}{3}$	=	$66\frac{2}{3}\%$
$\frac{2}{5}$	=	.4	=	$.40	=	40%
$\frac{3}{5}$	=	.6	=	$.60	=	60%
$\frac{4}{5}$	=	.8	=	$.80	=	80%
$\frac{5}{6}$	=	$.83\frac{1}{3}$	=	$\$.83\frac{1}{3}$	=	$83\frac{1}{3}\%$
$\frac{3}{8}$	=	$.37\frac{1}{2}$	=	$\$.37\frac{1}{2}$	=	$37\frac{1}{2}\%$
$\frac{5}{8}$	=	$.62\frac{1}{2}$	=	$\$.62\frac{1}{2}$	=	$62\frac{1}{2}\%$
$\frac{7}{8}$	=	$.87\frac{1}{2}$	=	$\$.87\frac{1}{2}$	=	$87\frac{1}{2}\%$

LESSON 67 ORAL. *IMPORTANT FRACTIONS IN BUSINESS PROBLEMS*

Find the cost of 9 base ball bats at 25¢ each.

Since 25¢ = $\$\frac{1}{4}$. 1 *bat costs* $\$\frac{1}{4}$. 9 *bats cost* $9 \times \$\frac{1}{4} = \$2\frac{1}{4}$.

Find the cost of 32 yd. of cloth at $\$.87\frac{1}{2}$ a yard.

Since $\$.87\frac{1}{2} = \$\frac{7}{8}$. 1 *yd. costs* $\$\frac{7}{8}$. 32 *yd. cost* $32 \times \$\frac{7}{8} = \$28$.

Find the cost of:

1. 27 yd. ribbon at $\$.33\frac{1}{3}$.
2. 48 cakes of soap at \$.25.
3. 48 lb. meat at $\$.16\frac{2}{3}$.
4. 40 pk. potatoes at $\$.12\frac{1}{2}$.
5. 36 lb. butter at $\$.33\frac{1}{3}$.
6. 84 base balls at \$.50.
7. 99 yd. cloth at $\$.66\frac{2}{3}$.
8. 72 yd. cloth at $\$.83\frac{1}{3}$.
9. 500 pk. nuts at \$.50.
10. 36 rd. fence at $\$.83\frac{1}{3}$.

Find .2 of 25. Since $.2 = \frac{1}{5}$, this means find $\frac{1}{5}$ of 25.

11. Find .75 of 48.
12. Find $.83\frac{1}{3}$ of 96.
13. Find .40 of 500.
14. Find $.37\frac{1}{2}$ of 320.
15. Find $.87\frac{1}{2}$ of 800.
16. Find .6 of 55.

What is $83\frac{1}{3}\%$ of 72? Since $83\frac{1}{3}\%$ of a number is $\frac{5}{6}$ of it, this means find $\frac{5}{6}$ of 72.

17. Find $87\frac{1}{2}\%$ of 32.
18. Find $33\frac{1}{3}\%$ of 360.
19. Find $12\frac{1}{2}\%$ of 72.
20. Find $66\frac{2}{3}\%$ of 30.
21. At $62\frac{1}{2}$¢ a pound, how much will 16 lb. of tea cost?
22. At $33\frac{1}{3}$¢ a pound, how much will 24 lb. of coffee cost?
23. At 20¢ a yard, find the cost of 8 yd. of cloth.
24. Find the cost of 8 lb. of coffee at 25¢ a pound.
25. Find the cost of 8 bu. of corn at $87\frac{1}{2}$¢ a bushel.
26. Find the cost of 10 doz. eggs at 20¢ a dozen.
27. Find the cost of 5 gal. of oil at 20¢ a gallon.
28. Find the cost of 50 bu. of potatoes at \$1.50 a bushel.
29. Find the cost of 18 yd. of cloth at $\$1.33\frac{1}{3}$ a yard.
30. Find the cost of 20 lb. of fish at 10¢ a pound.

IMPORTANT FRACTIONS IN BUSINESS PROBLEMS, ORAL

LESSON 68

1. At 25¢ each, how many things can you buy for $1?

2. At 25¢, how many base ball bats can you buy for $9?

Since at 25¢ each you can buy 4 bats for $1, for $9 you can buy 9 times 4 bats or 36 bats.

3. At 33⅓¢ each, how many things can you buy for $1?

4. At 33⅓¢, how many yards of ribbon can you buy for $4?

Since at 33⅓¢ a yard you can buy 3 yd. for $1, for $4 you can buy 4 times 3 yd. or 12 yd.

How many articles costing 33⅓¢ each can you buy for.

5. $12? **6.** $9? **7.** $1⅓? **8.** $2⅔? **9.** $3⅓?
10. $4⅔? **11.** $6⅓? **12.** $2⅔? **13.** $5? **14.** $8?

How many articles costing 25¢ each can you buy for:

15. $8 **16.** $12 **17.** $6¼? **18.** $5¾ **19.** $2½?
20. $5½? **21.** $3¼? **22.** $1¾? **23.** $15? **24.** $40?

How many articles costing 16⅔¢ each can you buy for:

25. $7? **26.** $5? **27.** $9? **28.** $20? **29.** $40?
30. $4⅓? **31.** $3⅙? **32.** $4½? **33.** $1⅚? **34.** $7½?

Divide the following:

35. $40 by 25¢
36. $12 by 50¢
37. $10 by 12½¢
38. $8 by 20¢
39. $15 by 33⅓¢
40. $20 by 25¢

41. How many bushels of potatoes at $.87½ a bushel can be bought for $14?

42. At $.66⅔ a pound, how many pounds of tea can be bought for $8?

43. How many pounds of cheese at 16⅔ cents a pound can you buy for $6?

44. At $.37½ a pound, how many pounds of coffee can you buy for $9?

Change to improper fractions:

1. $627\frac{5}{8}$ **2.** $327\frac{3}{4}$ **3.** $15\frac{1}{12}$ **4.** $18\frac{7}{16}$

Add and subtract:

5. $\begin{array}{r}21\frac{15}{16}\\ \underline{18\frac{1}{2}}\end{array}$ **6.** $\begin{array}{r}91\frac{4}{9}\\ \underline{62\frac{1}{3}}\end{array}$ **7.** $\begin{array}{r}83\frac{7}{8}\\ \underline{39\frac{5}{6}}\end{array}$ **8.** $\begin{array}{r}114\frac{4}{5}\\ \underline{72\frac{3}{10}}\end{array}$

Find the cost of:

9. $16\frac{2}{3}$ yd. at \$2.72. **10.** 63 yd. at \$.31$\frac{2}{3}$.

11. $18\frac{5}{6}$ doz. at 24¢. **12.** 44 books at \$.26$\frac{3}{4}$.

13. Change to common fractions: .8; .125; .375; .875; .0125; .0625; .025; .64; .95; .75.

Multiply:

14. $221\frac{1}{2}$ by 4 **15.** 264 by $2\frac{1}{2}$ **16.** $201\frac{1}{2}$ by 10

17. $362\frac{1}{3}$ by 3 **18.** 363 by $3\frac{1}{3}$ **19.** $403\frac{2}{3}$ by 12

20. $655\frac{2}{3}$ by 6 **21.** 244 by $4\frac{3}{4}$ **22.** $621\frac{4}{9}$ by 18

23. $421\frac{2}{5}$ by 5 **24.** 325 by $5\frac{3}{5}$ **25.** $369\frac{3}{5}$ by 25

Divide:

26. 25 by $2\frac{1}{2}$ **27.** $213\frac{1}{2}$ by 4 **28.** $263\frac{1}{2}$ by 12

29. 39 by $3\frac{1}{4}$ **30.** $321\frac{1}{3}$ by 3 **31.** $337\frac{1}{2}$ by 18

32. 36 by $3\frac{3}{5}$ **33.** $622\frac{1}{2}$ by 5 **34.** $422\frac{2}{5}$ by 16

35. 45 by $1\frac{1}{2}$ **36.** $220\frac{1}{2}$ by 6 **37.** $332\frac{3}{4}$ by 22

Multiply:

38. .03 × 14.6 **39.** .7 × .08 **40.** .08 × .06

41. 6.05 × 4.6 **42.** 4.1 × .4 **43.** 7.5 × .02

Divide:

44. 6.08 by .08 **45.** 18.03 by .03 **46.** 7.14 by .07

47. 36 by 1.2 **48.** 40.8 by 1.6 **49.** .05 by .025

50. 6.03 by 3 **51.** 6.03 by .003 **52.** 1846 by 100

Read:

53. 10.101 **54.** 111.11 **55.** 100.01 **56.** 12.005

57. 5.005 **58.** 101.01 **59.** 79.06 **60.** 6.025

1. What is 10% of $900? 40? $200? $10?

2. What per cent of $10 is $2.50? $5?

3. What per cent of 12 is 3? Of 120 is 60? Of 125 is 25?

4. 60 is 20% of what number? 50 is 25% of what number?

5. $70 is 10% of how many dollars?

6. A man paid $80 for a horse, and sold it for 10% more than it cost him. For how much did he sell it?

7. A man bought a horse for $80, and sold it for $88. How many dollars did he gain? What per cent did he gain?

8. A merchant paid $5 for a hat, and sold it at 20% profit. For what did he sell it?

9. A dealer paid $5 for a hat, and sold it for $6. What per cent did he gain?

10. A merchant bought velvet at $4 a yard, and sold it at $5 a yard. What per cent did he gain?

11. A merchant bought velvet at $5 a yard, and sold it for $4 a yard. What was the per cent of loss?

12. A horse that cost $100 was sold for $150. How many dollars was gained? What part of the cost was gained? What per cent was gained?

13. What is 25% of 8? 16? 24? 32?

14. What is 10% of 30? 50? 70? 90?

15. What part of 6 is 1? What per cent of it?

16. 3 is what part of 15? What per cent of it?

17. If I buy goods for $8 and sell them for $12, what per cent do I gain?

18. If goods that cost 75 cents a yard sell for 50 cents, how many cents are lost? What part of the cost is lost? What per cent is lost?

19. One boy threw a ball 100 ft. Another boy threw it 50% farther. How far did the second boy throw the ball?

20. Nellie is 37½% as old as her mother. If her mother is 40 years old, how old is Nellie?

1. What per cent of a square foot is 96 square inches?

$$\begin{array}{r} .66\frac{2}{3} \\ 144\overline{)96.00} \\ \underline{86\,4} \\ 960 \\ \underline{864} \\ \frac{96}{144}=\frac{2}{3} \end{array}$$

Since there are 144 sq. in. in a square foot, 96 sq. in. must be $\frac{96}{144}$ of a square foot. This is changed to *hundredths* or *per cent* as in Lesson 65.

2. What per cent of a mile is 64 rods?

3. Wood costs me $6.75 a cord. What shall I ask for it to gain 20%?

4. If a merchant buys flour for $6.00 a barrel, and sells it for $7.20 a barrel, what per cent does he gain?

5. How much is left after spending 7% of $825?

$$\begin{array}{r} \$8.25 \\ \underline{7} \\ \$57.75 \end{array} \qquad \begin{array}{r} \$825 \\ \underline{57.75} \\ \$768.25 \end{array}$$

Consider 7% as the decimal .07.
Find .07 of $825.
.01 of $825 is $8.25.
$.07 = 7 \times \$8.25 = \$57.75$

6. Find 27% of $864.50. This means find .27 of $864.50, that is, multiply $864.50 by .27.

All per cents not easily changed to small common fractions should now be considered as decimals and used decimally.

7. Find 18% of $1,680.50.

8. Find 75% of 488 bushels.

9. Find 5% of 360 feet.

10. I bought a horse for $250 and sold him at a loss of 20%. How much did I lose?

11. I expended 75% of my salary and had $450 left. What was my salary? Hint: $450 is what per cent?

12. What per cent of 250 is 50?

13. Find 2½% of 4678. 3⅓% of 3639.

14. Find 16% of $248. 24% of $678.

15. A merchant sold some goods for $18. If $3 of this was profit, find his gain per cent.

1. Compare a cubic foot and a cubic yard.

2. How many pieces of ribbon ¾ yd. long can be cut from 9 yards?

3. How many inch cubes will a 2-in. cubical box hold? A 4-in. cubical box?

4 At $2 a thousand, what will 1500 cu. ft. of gas cost?

5. 32 pounds is 33⅓% of George's weight. What is his weight?

6. *Find the cost of:*

a. ¾ yd. of cloth at 12¢ a yd. *b.* 8½ lb. beef at 12¢ a lb.
c. 1⅔ yd. ribbon at 18¢ a yd. *d.* 6 lb. steak at 16⅔¢ a lb.

7. How many square yards are there in a tablecloth 72 in. wide and 4½ yd. long? **(First change 72 in. to yards.)**

8. What per cent of a 2-in. square is a square inch? Are 2 square inches?

9. What per cent of a 2-in. cube are 2 cubic inches?

10. What part of 24 is 18? What per cent. is it?

11. A boy had 20 cents and lost 16 cents. What part of his money had he left? What per cent had he left?

12. If in an arithmetic test you answer correctly 8 questions out of 10, what part do you have right? What per cent do you have wrong?

13. What per cent of the months have 30 days?

14. 12 cents is 4% of Jennie's money. How much money has she?

15. 12 is ¼ of what number?

16. 12 is 25% of what number?

17. 12 is .25 of what number?

18. 21 is 7% of what number?

19. 21 is .07 of what number?

20. What is 9% of 200? 600? 3,000?

21. Find the perimeter of a square 2 ft. 4 in. long.

22. What will 2 lb. 2 oz. of butter cost at 32¢ a pound.

1. Multiply 184 by $7\frac{3}{4}$.

2. Find 16% of \$413.50. Of \$469.47.

3. Find 65% of 34,821. Of 3047.2.

4. If you had \$1,560 in a bank, and should draw out 35% of it, how much would you draw out? How much would remain in the bank?

5. At \$$3\frac{1}{2}$ a rod what will it cost to fence a rectangular lot 74 rods by 68 rods?

6. Add: $\frac{4}{7}+\frac{17}{21}+\frac{2}{3}+\frac{5}{7}$.

7. $50\frac{3}{5}-23\frac{5}{7}=?$

8. $\frac{1}{3}$ of one number is 639, and 6 times another number is 612. Find the sum of the two numbers.

9. Find the number of square inches in a piece of paper 7 ft. long and 9 inches wide.

10. How many inch cubes can be put into a box 28 in. long, 17 in. wide, and 13 in. deep?

11. 128 is $\frac{4}{5}$ of what number?

12. A man paid \$465 for a span of horses, and \$185 less for a carriage. Find the cost of both horses and carriage.

13. Find the cost of 12 coats at \$18.75 each?

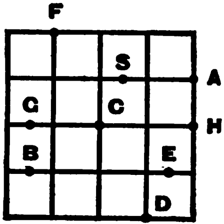
14. A farmer raised $57\frac{3}{4}$ bu. of wheat. He used $10\frac{1}{4}$ bu. for flour, and kept $8\frac{1}{2}$ bu. for seed. How many bushels were left?

15. A grocer sells $1\frac{1}{2}$ lb. of butter for 48 cents. How many half-pounds does he sell? How much is 1 half-pound worth? How much is one pound worth?

16. A storekeeper charges 75 cents for $\frac{3}{4}$ of a yard of silk. How much does he charge for each quarter of a yard? How much for 1 yard?

17. Carl's fish line was $50\frac{1}{2}$ yd. long. He gave Elwell $27\frac{3}{4}$ yd. of it. How many yards did Carl have left?

18. For every 25 papers a boy delivered, he made 15¢. If he delivered 200 papers each day for 2 weeks, how much money did he make?



These lines represent streets in a city. Each square represents a block. S represents the position of the schoolhouse. The other letters represent the homes of different pupils.

Scale ½ inch for 40 rods.

1. Find how many rods A must travel to go to school. What part of a mile?

2. How many rods would B travel? What part of a mile?

3. Answer the same questions for C, D, E, F, G, H.

4. How far would A travel if he called for E?

5. How far would B travel if he called for D?

6. How far would C travel if he called for G?

7. How far would D travel if he called for B?

8. How far would E travel if he called for H?

9. How far would F travel if he called for G?

10. How far would G travel if he called for B?

11. How far would H travel if he called for D?

12. If it takes 16 min. to walk a mile, how long will it take each pupil to go direct to school?

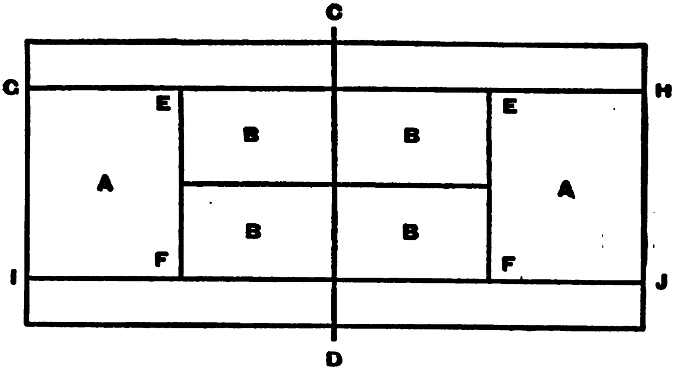
13. How long, when they call for their friends, as indicated in questions 4 to 12?

14. If A can ride his bicycle a mile in 10 min., how long will it take him to take this trip: From his house past H, E, C, G, and the schoolhouse to his home?

15. Riding at the same speed, how long will it take F, starting from his home, to go past the homes of G, B, D, E, H, and A to his home?

16. At the same rate, how long will it take G, starting from his home, to go to D's home on an errand, back home, and then to school?

17. How long will it take D to make the circuit of the square?



Scale 1 in to 24 ft.

This drawing represents a tennis court marked for playing. The part G, H, I, J is used when only one plays on a side, and is called "single court." The line C D represents the net.

1. Find the length and width of the whole court.

2. To make the single court, how wide a strip has been cut off from each side?

3. Find the area of the whole court. Find the area of the single court.

4. Find the length, width and area of A.

5. The line E F is how far from the net? Find the dimensions and area of B.

6. Find the areas of the two strips on each side. The area of these 2 strips is what part of the area of the whole court?

7. At 8¢ a square foot find the cost of land for a tennis court.

A croquet ground is usually 72 ft. by 36 ft. Using scale of 1 in. to 24 ft. draw a croquet ground and indicate position of arches and posts. Place posts 2½ ft. from end lines. Place side arches 7½ ft. from side lines.

8. Find the value of the ground at 75¢ a square yard.

9. Make a diagram of a football field 160 ft. by 330 ft. Scale ⅛ in. for 10 ft. On your drawing mark the cross lines 5 yd. apart. Find the area of the field.

New Haven, Feb. 1, 1909.

John D. Morse,

Bought of New Haven Furniture Co.

Jan.	25	36 yd. Ingrain Carpeting @ $.85	$30	60	$	
		48 yd. Brussels Carpeting @ $2.80	134	40		
		1 Parlor Set	175		340	00

Received payment

New Haven Furniture Co.

Per Frank Lee.

1. The above is a common form of a **bill.**

2. In the above bill who bought the goods?

3. The *buyer* or *purchaser* is the **debtor.** **(Dr.)**

4. Who sold the goods? The *person* or *firm* of whom the goods are bought is the **creditor.** **(Cr.)**

5. Name the debtor and creditor in this bill.

6. When were the articles bought? When was the bill made out?

7. Read the first item of the account. This item should give the *quantity* of the article purchased, its *price* and its *cost.*

8. State the quantity, price and cost of each item of this bill.

9. What was the *total amount* of the bill? The total amount is sometimes called the *footing.*

10. Notice carefully where every part of each item is placed.

11. When the bill is paid the words " Received payment " or " Paid " are written at the foot, followed by the creditor's name. This is called *receipting* the bill.

12. Give the name of the person who receipted the bill for the firm.

New Haven, Feb. 1, 1909.

John D. Morse,

To the New Haven Furniture Co., Dr.

Jan.	25	To 36 yd. Ingrain Carpeting, @ $.85	$30	60	$	
		" 48 yd. Brussels " @ 2.80	134	40		
		" 1 Parlor Set	175		340	00

Rec'd payt.

New Haven Furniture Co.

Per Frank Lee.

1. The above is another form of bill.

2. How does the heading differ from that of the bill in Lesson 76?

Use either form of heading and make out the following bills:

3. Mr. Lyman Smith, on Nov. 1, 1909, bought of Smith and Howard, 50 lb. coffee sugar @ 6¢; 10 lb. Java coffee @ 35¢; 4 lb. oatmeal @ 5¢; 8 doz. eggs @ 20¢; 4 gal. molasses @ 70¢; 50 lb. butter @ 25¢; 2 doz. lemons @ 25¢.

4. John Osgood, on Aug. 2, 1909, bought of R. H. Macy, 6 bbl. of pork @ $22.00; 431 lb. ham @ 17¢; 286 lb. beef @ 10¢; 362 lb. bacon @ 11¢; 18 bu. beans @ $2.00.

5. June, 1909, Chas. Brewer sold H. E. Tucker 10 bbl. rye flour @ $6.00; 40 bbl. St. Louis flour @ $7.00; 100 bu. corn @ $1.00; 100 bu. wheat @ $0.90.

6. June 14, 1909, J. H. Conner sold to W. T. Collins, 80 bu. yellow corn at 80¢; 100 bu. of rye @ $0.60; 200 bu. oats @ 30¢; 10 bbl. rye flour @ $6.00.

7. May 3, 1909, Chas. O. Ramsey sold to W. A. Bailey, 1 book-case, $29.00; 1 cottage bedstead, $4.50; 1 black walnut extension table, $19.00; 24 yd. stair carpeting @ 62¢; 1 hall mat, $3.50; 25 yd. Brussels carpeting @ 1.25.

Write the following bills, using either form:

1. May 17, 1909, Geo. W. Howe, Cr. J. O. Hancock, Dr. 8 yd. crash @ 20¢; 1 table-cover, $1.20; 40 gal. molasses @ 62¢; 4 gal. linseed oil @ $1.00; 25 lb. lead @ 13¢; 50 lb. of dried apples at 13¢.

2. James L. Davis bought on May 10, 1909, of Benj. B. Webb, 1 bbl. flour, $6.50; 8 bu. meal @ 90¢; 1 bbl. sugar (196 lb.) @ 8¢; 28 gal. molasses @ 62¢; 4 bu. potatoes @ 60¢; 10 bu. corn @ 75¢.

3. Fred Williams bought of J. Jackson & Co., Apr. 6, 1909, 2 pairs boy's boots @ $5.00; 1 pair ladies' boots @ $4.00; 1 pair rubber boots @ $4.00.

4. Joseph Hanson sold Samuel Bennett, on April 23, 1909, 2 cd. pine wood @ $3.00; 245 ft. lumber @ $3.25 per C.; 75 cd. hard wood @ $5.75.

5. April 21, 1909, John M. Flanders bought of Henry O. Turner 1 blank book, 30¢; 1 arithmetic, $1.25; 1 slate, 31¢; 4 quires paper @ 15¢; 19 yd. border @ 5¢.

6. Fred Bruce bought of H. W. Longley, Mar. 4, 1909, ½ bu. of apples @ 60¢; 2 bu. potatoes @ 63¢; 6 lb. butter @ 35¢; ½ bu. onions, 45¢; 4 cabbages @ 5¢; 3 lb. honey @ 32¢.

7. Mrs. James Shields bought of Henry Morse on April 15, 24 yd. cloth @ $3.80; 15 yd. velvet @ $4.50; and on May 10, 48 yards silk @ $3.50; 27 yd. cassimere @ $1.36. Send her bill on June 1.

8. Make out the following bill, supplying names and date; 3¾ lb. tea @ 60¢; 200 lb. sugar @ 4¾¢; 45 lb. rice @ 9⅓¢; 33 lb. cheese @ 15¢.

9. Make out a bill against your teacher that shall include five items of goods bought at a grocery store. Also one of goods bought at a market.

10. Make out a bill against a classmate of five items of goods bought at a dry-goods store.

The following is a weekly account of the hours of labor such as is usually kept for the employees of all manufacturing establishments.

Name	Wages	M.	T.	W.	T.	F.	S.	Hours	Days	Money Due
C. Cowles	$1.50	9	8	7	10	10	6			
J. Brown	1.80	8	4	8	9	8	6			
H. Hall	2.00	4	6	10	10	10	9			
C. Hyde	1.80	6	7	8	9	10	8			
J Smith	3.00	7	10	2	7	6	9			
Total										

1. Copy this time sheet.

2. Find out how many hours each man worked during the week.

3. Calling 10 hours a day's work, find out how many days each man worked.

4. How much did each man earn during the week?

5. As clerk or time keeper enter the number of days and hours of labor and the money earned in the proper column.

6. Fill out the totals also. How much money was paid out for labor by the above firm for the week?

7. How much money was lost during the week by each man because he did not work full time?

8. Answer the same questions for the following time sheet:

Name	Wages	M.	T.	W.	T.	F.	S.	Hours	Days	Money Due
A.	$2.00	6	8	9	7	5	6			
B.	2.25	8	10	5	0	8	7			
C.	3.00	8	9	10	6	10	9			
D.	3.50	10	0	10	10	10	10			
E.	2.75	7	6	8	9	10	8			
F.	3.00	8	7	9	8	9	10			
Total										

The following is an account of money received and paid out during one week.

Cash Account

Date.			Received		Paid	
July	1	Cash on hand	$45	75	$	
"	"	Beef				75
"	2	Vegetables				35
"	3	Milk bill for week			1	45
"	4	Contribution				50
"	"	Car-fare				20
"	5	Week's wages	15	00		
"	6	Groceries			5	46
"	7	Pair of shoes			3	00
"	8	Balance on hand				

1. Find the amount of money received and paid out during the week.

2. Finding the difference between the two amounts is called, "**Balancing the account.**"

3. Find the balance on hand and enter it in its proper place as cash on hand.

Make out and balance the following:

4. Cash on hand, Aug. 1, $31.00. Received week's salary Aug. 1, $50. Paid rent, Aug. 1, $30. Paid for coal, Aug. 2, $14.50. Paid for help, Aug. 3, $4.50. Received from money invested, Aug. 5, $75. Paid for groceries, Aug. 6, $9.71.

5. Cash on hand, Sept. 1., $72.50. Received week's salary Sept. 2, $62.50. Paid for groceries, Sept. 3, $9.63. Paid for milk, Sept. 4, $1.92. Paid doctor's bill, Sept. 4, $7.90. Received interest on deposit, Sept. 5, $32.18. Paid for dress goods, Sept. 5, $14.50. Paid for work, Sept. 5, $10.36.

6. Cash on hand July 10, $107.10. Received for work, July 10, $20.50. Paid for vegetables, July 11, $.88. Paid for suit of clothes, July 12, $37.50, hat $3.50. Paid for rent of cottage, July 13, $45. Received, July 15, dividends from bonds, $87.50. Paid, July 15, interest $26.30.

1. The following represents cash received and cash paid out in a store for the month of March. Write this in the form of a cash account and find the balance for March 31.

	Received.	Paid.		Received.	Paid.
1.	$247.85	$218.15	**17.**	$ 32.98	$ 3.95
2.	5.96	53.86	**18.**	500.00	188.50
3.	10.00	27.89	**19.**	50.00	74.00
4.	8.13	5.06	**20.**	48.75	50.00
5.	397.63	98.32	**22.**	85.35	79.85
6.	142.15	114.18	**23.**	18.50	41.25
8.	16.85	7.62	**24.**	45.50	134.14
9.	2.63	3.27	**25.**	446.14	9.63
10.	18.95	20.25	**26.**	532.13	2.65
11.	215.12	14.98	**27.**	513.68	1.60
12.	32.98	25.00	**29.**	180.00	27.84
13.	47.63	92.80	**30.**	39.39	14.65
15.	87.63	3.85	**31.**	557.00	136.00
16.	254.85	215.12			

2. Find the amount of money a farmer received if he sold the following: 105 bu. turnips @ 50¢; 111 bu. beets @ 80¢; 114 bu. parsnips @ 93¢; 215 bu. onions @ 98¢; 236 bu. tomatoes @ 42¢; 137 doz. cabbages @ 48¢.

3. Find the money he paid out if he bought at a market: 27 lb. pork @ 18¢; 32 lb. beef @ 12¢; 18 lb. mutton @ 14¢; 12 lb. veal @ 15¢; 18 lb. lamb at 17¢; 25 lb. ham @ 15¢.

4. Write the data given in examples 2 and 3 in the form of a cash account.

5. What is the meaning of debtor? Of creditor?

6. Write in the form of a cash account Feb. 1, Dr. Brown made 8 calls @ $2.00, and received 6 office visits @ $1.00. Feb. 2, he made 12 calls and received 10 office visits, and paid $17.00 for medicine. Feb. 3, he made 9 calls and received 8 office visits, and paid $40.00 for office rent.

1. If a man can do a piece of work in 15 days, what part of it can he do in one day?

2. If a man can mow a field of grass in 10 hours, what part of it can he mow in 1 hour?

3. If it takes 6 hours for a pipe to empty a cistern, what part of it can be emptied in 1 hour? In 2 hours? In 3 hours? In 4 hours?

4. If a family consume a barrel of flour in 40 days, what part of a barrel do they consume daily? In how many days do they consume ½ of the flour?

5. If it requires 18 days to perform a journey, what part of it can be performed in 1 day? In 3 days?

6. If A can do a piece of work in 4 days, and B in 2 days, what part of it can each do in a day? What part can both do in a day?

7. If A can mow a field in 4 days, and B can do it in 8 days, what part of it can each do in a day? What part can both do in a day?

8. If A and B can do ¼ of a piece of work in a day, how many days will it take them to do the whole work? How many days will it take them to do ½ of the work?

9. How many days will it take to do the whole of a piece of work if ⅓ of it can be done in 1 day?

10. If William can do a piece of work in 3 days and John in 6 days, what part of it can each do in a day? What part can both do in a day? How long will it take them to do it all?

11. Mary gave ⅗ of all her flowers to Anna and has 4 remaining. How many did she give away?

12. How much will 99 yards of dress goods cost at 33⅓¢ a yard?

13. How many yards of cloth costing 33⅓¢ a yard can be bought for $6?

14. What is the cost of 24 yd. of carpeting at $1.25 a yard?

15. Find the cost of 20 foot-balls at $2.50 each.

1. A man bought 225 acres of land at $15 an acre, and sold the whole for $3,125.

2. A man bought a farm for $3,695, and spent $947 in improvements, and sold it for $4,267.

3. Jones lost $400, and had ⅝ of his money remaining.

4. A grocer bought 5 bu. of apples at 62½¢ a bushel, and sold them at 12½¢ a peck.

5. A rectangular lot is 16 yd. long, and 39 ft. wide.

6. A man sold a horse for $80 and lost 20%.

7. ⅞ of a barrel of flour cost $4.20.

8. A square contains 100 sq. in.

9. An excavation 7 ft. deep was made for the cellar of a house 40 ft. long, 25 ft. wide.

10. The distance round a rectangular lot is 24 rd. The width of the lot is 6 rd.

11. The distance round a rectangular lot is 54 rd. The length of the lot is 15 rd.

12. A cube measures 8 in. on a side.

13. A rectangular solid is 12 in. long, 11 in. wide and 10 in. deep.

14. A. O. Strong bought of D. L. Day 76½ lb. of butter @ 22¢; 46 doz. eggs @ 22½¢; and 24 bbl. of apples @ $1.75.

15. A picture frame is 2½ inches wide. The picture inside of the frame measures 24 in. by 18 in.

16. A man left ½ of his property to his wife, ⅓ to his son and the remainder to his daughter. The daughter received $5000.

17. The surface of my office desk is 10 square feet. The desk is 4 ft. long.

18. $\frac{1}{20}$ of the pupils in a certain room are absent to-day. All of the pupils are present except 2.

19. There are 30 seats in a certain passenger train. In ½ of the seats there are two passengers, and in the rest there is only one. The average fare for each passenger was $2.55.

1. How many months are there in $\frac{2}{3}$ of a year? In $\frac{3}{4}$ of a year? In $\frac{5}{6}$ of a year?

2. How many hours are there in $\frac{5}{6}$ of a day? In $\frac{7}{8}$ of a day? In $\frac{7}{12}$ of a day?

3. How many months are there in .25 of a year? In $.33\frac{1}{3}$ of a year?

4. What part of a day is 6 hours? 9 hours? 12 hours? 8 hours?

5. How many square inches are there in the surface of a brick 8 in. long, 4 in. wide, 2 in. thick?

6. What per cent of $50 is $5? $10? 25?

7. If a merchant bought a piece of cloth for $80, and sold it at 25% profit, for how much did he sell it?

8. A merchant bought hats at $5 each, and sold them at 20% profit. What was the selling price?

9. A merchant bought hats at $5 each, and sold them at a loss of 20%. What was the selling price?

10. When cloth, costing $5 a yard, is sold for $4 a yard, what is the loss per cent?

11. If a merchant sells cloth, costing $4 a yard, for $5 a yard, what per cent does he gain?

12. If a man sold shoes at a profit of $2 a pair, and gained 20%, how much did they cost?

13. How must muslin that costs 10 cents a yard be sold to gain 20%?

14. $\frac{8}{9}$ of 27 is what number?

15. $\frac{5}{9}$ of 81 is what number?

16. $\frac{2}{7}$ of 21 is what number?

17. 18 is $\frac{2}{5}$ of how many?

18. 24 is $\frac{3}{8}$ of how many?

19. If 4 chickens cost 9 dimes, what will 1 chicken cost?

20. What will 1 lb. of prunes cost if 5 lb. cost 6 dimes?

21. If 3 apples cost $\frac{6}{7}$ of a cent, what will 7 apples cost?

1. Mr. John Morris bought of Chas. Scott & Co., on Aug. 27, 1 09, 25 lb. sugar @ 7¢; 11 lb. tea @ 45¢; 12 lb. coffee @ 36¢; 22 lb. raisins @ 12¢; 19 lb. currants @ 9¢; 17 lb. crackers @ 9¢. Make out a bill, and receipt it as clerk.

2. Divide 766,080 by 315. 701,153 by 211.

3. Multiply 3,548 by 368. 6,497 by 309.

4. A farmer has 7 lots, in each of which he pastures 9 cows. Each cow gives 12 qt. of milk a day. If he sells the milk at 6¢ a quart, how much does he receive in a week?

5. If 16 bu. of potatoes cost $10, how many bushels can be bought for $25?

6. If 8 lb. of wool are obtained from one sheep in a year, how much money will a man receive from a flock of 48 sheep, when wool is 33⅓¢ a pound?

7. What will it cost to paint the walls and ceiling of a room 36 ft. by 27 ft., and 12 ft. high, at $1.20 a square yard?

8. A farmer sold to a grocer 26 bu. of apples, at $1.25 a bushel, and took his pay in flour at $3.25 a barrel. How many barrels did he receive?

9. A farmer sold 2 loads of hay, one for $15¾, and the other for $18⅗. How much should he receive for both loads? If he received $28 in cash, how much is still due?

10. If 9½ tons of hay cost $95, how many tons can be bought for $108?

11. At 35¢ a peck, how many bushels of potatoes can be bought for $119.00?

12. Find the value of a piece of land 33 ft. by 40 rd., at $5 a square rod.

13. A man bought a number of cows for $1,920. He sold them for $2,400. How much did he gain? If he gained $10 on each cow, how many cows were there?

14. Divide 8,763⅓ by 11.

15. If 56 men can do a piece of work in 21 days, how long will it take 24 men to do it?

1. How many are $\frac{3}{5}$ of $40?

2. How many are $40 \times \frac{3}{5}$?

3. How many are 60% of 40?

4. What per cent of 10 yd. is 3 yd.? 5 yd.? 7 yd.?

5. What is 25% of 460 pounds?

6. What is 7% of 600 bushels?

7. What is 8% of 1000 rods?

8. From a school of 750 pupils 20% were absent. How many were present?

9. What per cent of 150 is 30?

10. What per cent of 18 is 6?

11. A man bought a farm of 200 acres, and sold 50 acres of it. What part of his farm did he sell? What per cent of his farm did he sell?

12. A man bought a cow for $35, and sold her at 20% profit. How much did he gain? For how much did he sell her?

13. A grocer bought flour at $4 a barrel, and sold it at 25% loss. How much did he lose? For what did he sell it?

14. I bought a horse for $200, and sold it for $50 less than cost. What part did I lose? What per cent did I lose?

15. If you buy tea at 60¢ a pound, and sell it at 80¢ a pound, how many cents will you gain? What part will you gain? What per cent?

16. If you buy a rubber ball for 8 cents, and sell it for 6 cents, how many cents will you lose? What part will you lose? What per cent?

17. If you buy an orange for 4 cents, how many cents must you gain to make 50%?

18. 12 is $\frac{1}{4}$ of what number? 25% of what number?

19. 12 is .25 of what number?

20. 21 is 7% of what number? 21 is .07 of what number?

21. What is 9% of 200? 600? 3000?

22. What is $66\frac{2}{3}$% of 12? 36? 300?

1. A man owns a farm of 150 acres. If he planted 30% of his farm, how many acres did he plant?

2. A man bought a horse for $180 and sold it so as to gain 10% of its cost. What did he gain?

3. An agent sold a house for $3600. If his commission was 4%, how much did he receive?

4. A merchant bought an article for $12 and sold it for $15. How much did he gain? What part of the cost did he gain? What per cent did he gain?

5. A man, having 400 bushels of wheat, sold 50 bushels. What part of his wheat did he sell? What per cent did he sell?

6. Mr. Brooks received a salary of $2400. If he spent 16⅔% of it for board, what did he spend for board?

7. After paying for his board Mr. Brooks spent 25% of what was left of his salary for other expenses. What did he pay for other expenses? How much of his salary had he left?

8. Find 62½% of $486.

9. Find 96% of 265 bushels of oats.

10. A man bought a farm for $3200 and sold it at a loss of 16%. How many dollars did he lose?

11. A man bought 600 tons of coal at $3 a ton. How much did he pay for it? He sold it so as to gain 25%. For what did he sell it?

12. An agent sold 675 bu. of potatoes at 60 cents a bushel. What was his commission at 5%?

13. There were 1550 inhabitants in a town. 2% died in one year. How many died?

14. A wagon that cost $48 was sold for $60. How much was gained? What part of the cost was gained? What per cent was gained?

15. If a man sells anything at half of its cost, what per cent does he lose?

16. A rectangle measures 16 in. by 20 in. How many more square inches are there in a rectangle that measures 25% more on each side?

1. How many square inches are there in a square that is —— inches on a side? How many square inches in a square that is —— inches more on a side? How many square inches in both squares?

2. I bought —— ounces of candy; what part of a pound did I buy?

3. What number is —— more than ——?

4. A bin held —— bushels of potatoes, how many pecks were there?

5. A rectangle is —— inches wide, and twice as long as wide. What is its perimeter?

6. I have —— apples, and my brother has ——. How many must I give my brother that we may have the same number?

7. A book and a picture cost $——. If the book cost $——, what did the picture cost?

8. Find —— per cent of ——.

9. Find —— per cent of ——.

10. If I use —— sheets of paper, what per cent of a quire do I use? There are 24 sheets of paper in a quire.

11. If I buy shoes for $ —— a pair, and sell them for $—— a pair, what per cent do I gain?

12. If a man buys a watch for $——, and sells it for $——, what per cent does he lose?

13. If you buy a knife for ——, for how much must you sell it to gain ——%?

14. There are —— hours between —— A.M. and —— P.M.

15. There are —— minutes between —— A.M. and —— P.M.

16. —— —— of $1 = —— cents.

17. At —— each, you can buy —— —— for 50 cents.

18. —— cents are —— —— of $1.

19. At —— each, you can buy —— —— for $5.

20. There are —— seconds in —— minutes.

1. A man sold a horse for $233.05 and gained $35.55.

2. A dealer bought 50 buffalo robes at $8 each, and sold them at 16% loss.

3. A man bought 25,460 lb. of cotton at 8¢ a pound. A fire destroyed ¼ of it. He sold the rest of it at 11¢ a pound.

4. A farmer raised 1,860 bu. of potatoes. He sold 60% of them at 65¢ a bushel, and the remainder at 85¢ a bushel.

5. I bought cloth for $58⅖, and sold it for $49¾.

6. Cloth costing $16.85 is sold at a loss of 8%.

7. Hay costing $16.85 is sold at a loss of 15%.

8. 7.2 acres of land yielded 576 bu. of corn.

9. A man bought 7360 lb. of coal at $6.25 a ton.

10. A man bought 8 horses at $135 each and 6 at $130.50.

11. I paid $6.75 for coffee at 25¢ a pound.

12. 10 years ago the population of a certain city was 60,000. Since then it has increased 40%.

13. A man paid $184 for apples at $1⅗ a barrel.

14. A farmer gave 6 doz. eggs, worth 16¢ a dozen, for 30 lb. of sugar at 4¢ a pound.

15. The sum of two numbers is 27, and the greater number is 19.

16. Hay was worth $12 a ton, three months ago. To-day it is 50% higher than it was then.

17. $240 is 40% of all my money.

18. A floor is 14 ft. by 17 ft.

19. A commission merchant sold 80 tons of hay at $17.50 a ton. His commission was 3%.

20. A real estate dealer bought 5½ acres of land and cut it up into 16 house lots. There are 160 sq. rd. in an acre.

21. The premium for insuring a house at 2% was $40.

22. The cash sales in a certain store last week were $175.88. This week they were $206.25.

23. A pile of wood measures 24 ft. x 4 ft. x 6 ft.

1. $\frac{1}{2}$ of a circle equals —— fourths of a circle. $\frac{1}{2}$ of a square is —— times $\frac{1}{4}$ of a square.

2. $\frac{1}{2}$ of 20 cents and $\frac{1}{4}$ of 20 cents equal —— cents.

3. $\frac{1}{4}$ of a peck equals —— quarts.

4. $\frac{1}{2}$ of a bushel equals —— pecks or —— quarts.

5. $4\frac{1}{4}\times 4=$ ——. $6\times 2\frac{1}{2}=$ ——. $9\times 2\frac{1}{3}=$——.

Add and subtract:

6. $\begin{array}{r}6\frac{1}{4}\\ \underline{3\frac{1}{8}}\end{array}$ **7.** $\begin{array}{r}9\frac{1}{3}\\ \underline{5\frac{1}{6}}\end{array}$ **8.** $\begin{array}{r}9\frac{3}{4}\\ \underline{4\frac{1}{2}}\end{array}$ **9.** $\begin{array}{r}7\frac{1}{2}\\ \underline{2\frac{1}{3}}\end{array}$ **10.** $\begin{array}{r}12\frac{1}{2}\\ \underline{5\frac{1}{6}}\end{array}$

11. How much is $3\frac{1}{2}$ times 4? 8 times $1\frac{1}{2}$?

12. How much is $2\frac{1}{4}$ times 8? 8 times $1\frac{1}{4}$?

13. Jennie bought 9 yards of ribbon at $\$\frac{1}{3}$ a yard. How much was paid for the ribbon?

14. Find the cost of 12 quarts of berries at $\$.16\frac{2}{3}$ a quart.

15. *Find the cost of 24 articles at:*
$\$\frac{1}{2}$ each; $\$\frac{1}{4}$ each; $\$\frac{1}{8}$ each; $\$\frac{1}{6}$ each; $\$\frac{3}{4}$ each.

16. *Read in two ways:*
$\$\frac{1}{2}$; $\$\frac{1}{5}$; $\$\frac{1}{4}$; $\$\frac{3}{8}$; $\$\frac{4}{5}$; $\$\frac{2}{3}$; $\$\frac{5}{8}$; $\$\frac{2}{5}$; $\$\frac{7}{8}$.

17. *Reduce to lowest terms:*
$\frac{3}{6}$, $\frac{8}{12}$, $\frac{5}{25}$, $\frac{4}{20}$, $\frac{4}{6}$, $\frac{6}{24}$, $\frac{8}{16}$, $\frac{3}{15}$, $\frac{9}{27}$, $\frac{6}{18}$, $\frac{5}{15}$, $\frac{3}{9}$, $\frac{2}{8}$, $\frac{5}{20}$, $\frac{9}{12}$, $\frac{3}{18}$, $\frac{6}{9}$, $\frac{6}{36}$, $\frac{8}{24}$, $\frac{9}{45}$.

18. $\frac{1}{2}+\frac{3}{4}+\frac{1}{4}+\frac{1}{2}=?$ **19.** $\frac{1}{2}+\frac{1}{3}+\frac{3}{6}+\frac{2}{3}=?$

20. $\frac{1}{6}+\frac{1}{3}+\frac{2}{6}+\frac{1}{6}=?$ **21.** $\frac{1}{2}+\frac{1}{4}+\frac{7}{8}+\frac{1}{4}=?$

22. Change to halves: 2, $3\frac{1}{2}$, 5, $7\frac{1}{2}$, $4\frac{1}{2}$.

23. Change to fourths: 1, $2\frac{1}{4}$, 3, $4\frac{3}{4}$, 5, $3\frac{2}{4}$.

24. Change to integers: $\frac{12}{4}$, $\frac{15}{3}$, $\frac{18}{6}$, $\frac{21}{7}$, $\frac{30}{5}$, $\frac{16}{4}$, $\frac{56}{8}$.

25. Change to thirds: 3, $4\frac{1}{3}$, 5, $2\frac{4}{6}$, $3\frac{2}{3}$.

26. $5\frac{1}{3}-2\frac{1}{6}=$ ——. $8\frac{1}{4}-3\frac{1}{8}=$ ——.

1. If your father owned $\frac{1}{5}$ of a factory worth \$30,000, and sold $\frac{1}{6}$ of it, what part would he then own? What would it be worth?

2. Multiply 6,845 by .25; by .7; by .725.

3. Divide 23.04 by 3; by 6; by 30.

4. Divide 7.14 by .02; by .3; by .07.

Add by columns and lines:

5. *a.* *b.* *c.* *d.*
e. $\frac{2}{4}+\frac{2}{3}+\frac{1}{2}+\frac{3}{6}$
f. $\frac{1}{3}+\frac{3}{4}+\frac{5}{8}+\frac{1}{2}$
g. $\frac{1}{2}+\frac{1}{3}+\frac{3}{4}+\frac{5}{6}$
h. $\frac{5}{6}+\frac{8}{9}+\frac{1}{8}+\frac{1}{2}$
i. $\frac{1}{4}+\frac{1}{2}+\frac{4}{12}+\frac{2}{8}$

6. *a.* *b.* *c.* *d.* *e.*
f. $\frac{1}{4}+\frac{1}{8}+\frac{1}{2}+\frac{5}{6}+\frac{5}{12}$
g. $\frac{2}{3}+\frac{3}{4}+\frac{4}{8}+\frac{1}{2}+\frac{2}{6}$
h. $\frac{5}{12}+\frac{1}{2}+\frac{2}{3}+\frac{3}{8}+\frac{3}{4}$
i. $\frac{3}{8}+\frac{3}{12}+\frac{4}{6}+\frac{2}{3}+\frac{1}{8}$
j. $\frac{4}{6}+\frac{3}{8}+\frac{3}{4}+\frac{3}{12}+\frac{1}{2}$

Subtract:

7. *a.* $46\frac{15}{22}-4\frac{9}{11}$. *b.* $96\frac{25}{32}-45\frac{7}{8}$. *c.* $200\frac{2}{9}-90\frac{17}{18}$.
d. $78\frac{36}{49}-21\frac{6}{7}$. *e.* $42\frac{4}{16}-16\frac{3}{4}$. *f.* $173\frac{18}{27}-72\frac{8}{9}$.

8. How many feet of barbed wire will be required to go round a field $194\frac{5}{12}$ft. long and $84\frac{1}{6}$ ft. wide?

9. A man bought some wheat for \$$42\frac{3}{8}$, and some corn for \$$27\frac{3}{4}$. If he paid \$$51\frac{1}{2}$, how much does he still owe?

10. How many rods is it round a field that is $42\frac{1}{4}$ rd. long, and $36\frac{3}{4}$ rd. wide? How many yards is it?

11. If barbed wire costs 2¢ a foot, what will it cost to put 5 wires round the above field?

12. A man left a fortune of \$96,420. His wife received $\frac{2}{8}$, his son $\frac{1}{4}$, and his niece the remainder. How much did each receive?

13. A farm is divided into 4 fields containing $19\frac{3}{4}$ A., $45\frac{5}{12}$ A., $35\frac{1}{3}$ A., and $62\frac{1}{2}$ A. How many acres are there in the farm?

14. A merchant buys an article for \$$99\frac{1}{4}$, and sells it for \$$102\frac{1}{8}$. Find his gain on 48 articles.

1. Given the cost of one article and the number of articles. What can you find? How?

2. Given the cost of all the articles and the number of articles. What can you find? How?

3. Given the cost of all the articles and the cost of one article. What can you find? How?

4. Given the cost and selling price. What can you find? How?

5. Given the gain and selling price. What can you find? How?

6. Given the cost and loss. What can you find? How?

7. Given the loss and selling price. What can you find? How?

8. Given the sum of two numbers and one number. What can you find? How?

9. Given the sum of several numbers and all but one of the numbers. How can you find the other number?

10. Given two numbers. What things can you find?

11. Given the product of two numbers and one number. What can you find? How?

12. Given the difference of two numbers and one number. What can you find? How?

13. Given the quotient of two numbers and the smaller number. What can you find? How?

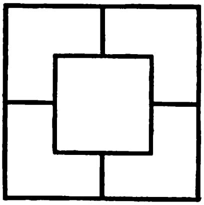
14. Given the quotient of two numbers and the larger number. What can you find? How?

15. Given the length and breadth of a rectangle. What can you find? How?

16. Given the area and one side of a rectangle. What can you find? How?

17. Given the dimensions of a right prism. What can you find? How?

18. Given the three dimensions of this room. What can you find? How?



Scale ¼

1. Make a drawing of full size of this block of patchwork.

a. Making no allowance for seams how many blocks can be cut from 1 sq. yd. of muslin?

b. These blocks are sewed into strips 1 ft. wide and 6½ ft. long. How many blocks did it take for each strip?

c. The quilt is made up of strips of pieced blocks alternating with plain strips. If the quilt is 5 ft. wide how many strips of each kind will be needed?

d. Find the number of pieced blocks needed for the whole quilt.

e. How many yards of muslin will be needed for the plain strips?

f. Find the cost of the plain muslin at 15¢ a yard.

g. Find the cost of lining for the quilt at 12¢ a yard.

h. If Mary can make 1 block in ¾ of an hour, how long will it take her to make the pieces needed for the quilt?

2. How many posts and how many rails will be required for a fence 156 ft. long, if the posts are set 12 ft. apart and the fence is 5 rails high?

3. A man bought a piece of land 1200 ft. long and 420 ft. wide at 25¢ a square foot. How much did it cost him?

4. A letter was postmarked Minneapolis, Minn., 8 P.M., June 17, and stamped New Haven, Conn., 6 A.M., June 19. How long did it take the letter to reach its destination?

5. From your geography find the distance traveled. What was the average distance traveled each hour?

6. A letter was postmarked Paris, May 24, '09, and was received in New York June 3, '09. Find the approximate distance from Paris to New York. What distance was traveled each day?

7. Examine the postmarks of some letters at home, and make problems for classmates to solve.

1. *Add:*

$2\frac{1}{3}$ and $3\frac{1}{4}$
$1\frac{2}{3}$ and $3\frac{1}{2}$
$2\frac{1}{4}$ and $3\frac{1}{6}$
$6\frac{1}{5}$ and $5\frac{1}{6}$
$3\frac{1}{4}$ and $2\frac{3}{5}$
$8\frac{1}{4}$ and $6\frac{1}{5}$
$4\frac{1}{6}$ and $2\frac{1}{2}$
$8\frac{2}{3}$ and $3\frac{5}{6}$
$6\frac{1}{4}$ and $2\frac{2}{3}$

2. If a man walks $3\frac{1}{4}$ miles the first hour, and $3\frac{1}{5}$ miles the second, how far does he walk in two hours?

3. *What is the value of:*

$\frac{1}{2}-\frac{1}{4}$
$\frac{3}{4}-\frac{2}{3}$
$\frac{5}{6}-\frac{3}{4}$
$\frac{3}{4}-\frac{1}{3}$
$\frac{2}{3}-\frac{1}{6}$
$\frac{2}{3}-\frac{2}{9}$
$\frac{1}{4}-\frac{1}{8}$
$\frac{1}{2}-\frac{1}{8}$
$\frac{5}{6}-\frac{3}{12}$
$\frac{2}{3}-\frac{1}{2}$
$\frac{2}{3}-\frac{3}{5}$
$\frac{5}{6}-\frac{2}{3}$

4. A farmer bought a sheep for \$$3\frac{1}{4}$, and sold it for \$$4\frac{1}{5}$. How much did he gain?

5. Arthur is $6\frac{2}{3}$ years old, and Bessie is $8\frac{1}{5}$ years old. What is the sum of their ages? How much older is Bessie than Arthur?

6. Mr. Morse is 40 years old, and his daughter Eva is $\frac{3}{8}$ as old. How old is Eva?

7. A man sold $\frac{1}{2}$ of his sheep to one man, $\frac{1}{5}$ to another. What part had he left? If he had 6 remaining, how many had he at first?

8. Mr. Wood makes a profit of $21\frac{1}{2}$ cents on every bag of meal he sells. What will be his profit on 4 bags?

9. Mr. R. gets 25 cents an hour for his work. How much will he get for 24 hours' work? How many hours must he work to earn $15?

10. *Find the cost of:*

$\frac{3}{4}$ yd. of cloth at 12¢ a yard. $8\frac{1}{2}$ lb. of beef at 12¢ a pound.
$1\frac{2}{3}$ yd. ribbon at 18¢ a yard. 6 lb steak at $16\frac{2}{3}$¢ a pound.

11. What is $\frac{1}{3}$ of 2 in.? $\frac{1}{6}$ of $\frac{1}{2}$ in.?

12. What is $\frac{2}{3}$ of 6? $\frac{3}{4}$ of 8? $\frac{3}{5}$ of 15?

13. If you divide an inch into halves, and then divide each of these halves into 4 equal parts, what portion of an inch will each part be?

1. Multiply 864 by $16\frac{2}{3}$.

2. Divide 14,400 by $16\frac{2}{3}$.

3. Reduce to simplest form $\frac{15}{16} \div \frac{8}{9}$.

4. Divide $\frac{8}{9}$ by $\frac{7}{12}$.

5. Multiply $\frac{12}{15}$ by $\frac{9}{10}$. $\frac{12}{33}$ by $\frac{11}{14}$.

6. Multiply $8\frac{8}{9}$ by 24. $63\frac{4}{7}$ by 56.

7. From $55\frac{1}{2}$ take $38\frac{1}{6}$. From $54\frac{1}{4}$ take $21\frac{2}{7}$.

8. Add $12\frac{3}{5}$, $28\frac{5}{6}$, and $15\frac{2}{3}$.

9. Multiply .596 by .008. 2.007 by .409.

10. Divide 6.144 by .004. .128 by .256.

11. If $\frac{5}{8}$ of a field is worth \$325, what is the whole field worth?

12. If $\frac{2}{3}$ of a farm is worth \$4,900, what is $\frac{3}{4}$ of it worth?

13. A man who owned $\frac{3}{4}$ of a ship sold $\frac{4}{5}$ of his share for \$21,000. What was the value of the whole ship?

14. Divide .027 by .45.

15. Simplify: $\dfrac{1\frac{1}{2}}{\frac{1}{2}}$ $\qquad$ $\dfrac{3\frac{4}{5}}{1\frac{1}{10}}$ $\qquad$ $\dfrac{8\frac{1}{2}}{7\frac{2}{3}}$

16. A man's house rent is 480 a year. This is $\frac{3}{8}$ of his salary. Find his salary. If he saves $\frac{1}{5}$ of his salary every year, how long will it take him to save \$2,304?

17. A man owning .68 of an acre of land, sold .25 of what he owned. What part of an acre did he sell, and what part did he have left?

18. A man lost \$12,000. If he had $\frac{11}{15}$ of his money left, how much had he at first?

19. At $\$1\frac{3}{5}$ a basket, how many baskets of peaches can be bought for \$352?

20. At $\$3\frac{4}{5}$ a yard, how much will $58\frac{3}{4}$ yd. of velvet cost?

21. A cubic foot of water weighs $62\frac{1}{2}$ pounds. Find the weight of water in a tank measuring 8 ft. x $4\frac{1}{2}$ ft. x 3 ft.

22. If a cup holds $\frac{3}{16}$ of a quart, how many cupfuls are there in $6\frac{1}{4}$ quarts?

1. From 1.2 take .7.

2. From .1 take .01. From .1 take .001.

3. Oscar has $.2, and his brother has 5 times as much. How much money has his brother?

4. $1.5 \times 4 = ?$ **5.** $.3 \times 8 = ?$ **6.** $.4 \times 5 = ?$

7. $.05 \times 5 = ?$ **8.** $.14 \times 2 = ?$ **9.** $.03 \times 7 = ?$

State the products by imagining the decimal points to be moved:

10. 3.78×100 **11.** $.80 \times 100$ **12.** 4.02×100

13. 1.05×10 **14.** $.3 \times 10$ **15.** 6.4×10

16. 31.4×100 **17.** 16.1×10 **18.** 70.2×100

19. $.004 \times 1000$ **20.** 7.016×1000 **21.** 6.04×1000

22. Find $\frac{1}{4}$ of .9; 1.5; .12; 2.7.

State quotients by imagining the decimal points to be moved:

23. $.5 \div 10$ **24.** $1.2 \div 10$ **25.** $.04 \div 10$

26. $4.5 \div 100$ **27.** $26.1 \div 100$ **28.** $1.05 \div 100$

Read:

29. 4.5 **30.** 300.003 **31.** 100.01 **32.** 4.1

33. 1000.001 **34.** 1.005 **35.** 2000.02 **36.** .003

37. Read 2.02 as hundredths.

38. Read 3.003 as thousandths.

Change to common fractions in their lowest terms:

39. .2 **40.** 1.5 **41.** .50 **42.** .75

43. $.12\frac{1}{2}$ **44.** $.33\frac{1}{3}$ **45.** $.16\frac{2}{3}$ **46.** $.66\frac{2}{3}$

47. .80 **48.** $.87\frac{1}{2}$ **49.** .25 **50.** $.37\frac{1}{2}$

Divide:

51. 4.9 by .7 **52.** 14.4 by 1.2 **53.** 7.5 by 2.5

54. .25 by .05 **55.** .81 by .09 **56.** .84 by .07

1. Divide .0672 by .042.

2. Divide 2 by .0002.

3. Multiply .009 by .009.

4. From .9 take 9 ten-thousandths.

5. Change to decimals: $16\frac{2}{3}$, $\frac{7}{15}$, $\frac{18}{50}$, $\frac{3}{8}$.

6. Divide 810.48 by 24.56. 97.524 by .1806.

7. What is the value of .8 acres of land at $145.50 an acre?

8. If 1.25 acres of land are worth $87.50, what is the worth of 24.5 acres?

9. From six hundred dollars and thirty-six cents take two hundred eighty-four and seven-hundreths dollars.

10. Reduce to common fractions: .95; .525.

11. Divide 96 thousandths by 384 hundred-thousandths.

12. Reduce $\frac{54}{270}$ to a decimal fraction.

13. Add 63.43, .475, 11.674, 1.02.

14. Add 435.075, 21.07, .035, 2000.02.

15. Add four hundred and fifty-six hundredths; eight thousand four hundred and seventy-two thousandths; fifteen thousand seven hundred and twenty-one hundredths; forty-three million seven hundred thirty-three thousand eight hundred three and fifty-three thousandths.

16. If .9 of a ton of coal costs $5.67, what must I pay for 71.25 tons?

17. How many square feet are there in a walk 18.75 ft. long, and 2.8 ft. wide?

18. Add 4 and 7 tenths, 86 thousandths, 75 and 3 thousandths, 13 hundredths.

19. How many tons are there in 3 cars of coal, the first car containing 19.625 tons, the second car 37.125 tons, and the third car 29.375 tons?

20. What will 41.5 bu. of potatoes cost at $.875 a bushel?

21. $1.05 \times .005 \div 25 = ?$ $3.84 \times 7.5 \div .5 = ?$

22. $71.042 + 26.106 + 5.175 - 56.075 = $ ——?

1. What is a fraction?

2. The numerator of a fraction is 2 and the denominator is 4. How does this fraction compare with $\frac{1}{2}$?

3. Draw a rectangle 2 in. by 1 in. Shade $\frac{1}{2}$ of it. Into how many parts is the rectangle divided?

4. Express as fractions: $1 \div 3$; $2 \div 5$; $3 \div 4$.

5. Since fractions express division, express the following fractions as examples in division: $\frac{1}{5}$, $\frac{3}{6}$, $\frac{1}{2}$, $\frac{2}{3}$, $\frac{5}{6}$, $\frac{7}{8}$.

6. When peaches are marked 2 for 3 cents, how much is that for one?

7. How many sixths are there in $\frac{2}{3}$? In $\frac{1}{2}$? In $\frac{8}{12}$?

8. Change to twelfths: $\frac{1}{2}$, $\frac{2}{3}$, $\frac{1}{4}$, $\frac{5}{6}$, $\frac{10}{24}$, $\frac{12}{36}$.

9. $2\frac{3}{5} + 4\frac{3}{10} =$ ——. $7\frac{1}{2} + 6\frac{3}{4} =$ ——.

10. Change to lowest terms: $\frac{8}{12}$, $\frac{6}{24}$, $\frac{7}{28}$, $\frac{10}{15}$, $\frac{7}{14}$.

11. Why is $1\frac{2}{3}$ called a mixed number?

12. Change to mixed numbers: $\frac{8}{3}$, $\frac{7}{2}$, $\frac{11}{4}$, $\frac{12}{5}$, $\frac{26}{6}$.

13. $\frac{1}{2} + \frac{1}{3} =$ ——. $\frac{1}{3} + \frac{1}{4} =$ ——. $\frac{1}{4} + \frac{1}{5} =$ ——. $\frac{1}{5} + \frac{1}{6} =$ ——.

14. $\frac{1}{2} - \frac{1}{3} =$ ——. $\frac{1}{3} - \frac{1}{4} =$ ——. $\frac{1}{4} - \frac{1}{5} =$ ——. $\frac{1}{5} - \frac{1}{6} =$ ——.

15. What is the sum of $\frac{3}{8}$ of a bushel and $\frac{1}{4}$ of a bushel?

16. What is the sum of $\frac{1}{2}$ of a dollar and $\frac{3}{5}$ of a dollar?

17. From the fraction $\frac{2}{4}$, prove that multiplying the numerator of the fraction multiplies the value of the fraction.

18. From the same fraction prove that dividing the denominator of the fraction multiplies the value of the fraction.

19. Multiply the fraction $\frac{1}{8}$ by 2, first by multiplying the numerator by 2, and again by dividing the denominator by 2.

20. From the fraction $\frac{3}{6}$ prove that dividing the numerator of a fraction divides the value of the fraction.

21. From the same fraction prove that multiplying the denominator of a fraction divides the fraction.

22. From the same fraction prove that multiplying or dividing both terms of a fraction by the same number does not change its value.

1. If $\frac{2}{3}$ of a yard of cloth cost \$$4\frac{2}{5}$, what will $2\frac{1}{2}$ yards cost?

2. Find the sum of $2\frac{1}{2}$, $5\frac{2}{3}$, and $8\frac{4}{5}$.

3. What number is $3\frac{1}{2}$ less than $5\frac{5}{8}$?

4. I bought $\frac{1}{2}$ of a store for \$1,400. At the end of the year I sold $\frac{1}{3}$ of my share for \$600. At that rate how much had my interest increased during the year?

5. How many dozen eggs at 24¢ a dozen will pay for 48 lb. of crackers at $7\frac{1}{2}$¢ a pound?

6. Add: $13\frac{3}{5}$, $15\frac{3}{8}$, $11\frac{2}{3}$, $18\frac{1}{5}$.

7. If a man travels 700 miles in $8\frac{3}{4}$ days, how far will he travel in $17\frac{1}{2}$ days?

8. Divide 28 by $2\frac{1}{2}$. 45 by $4\frac{1}{3}$.

9. A boy rides his bicycle $4\frac{1}{4}$ hr. in the morning, and $3\frac{2}{3}$ hr. in the afternoon. If he rides $8\frac{2}{3}$ miles an hour, how many miles will he ride in the day?

10. The remainder is $35{,}201\frac{5}{6}$, and the subtrahend $21{,}056\frac{3}{4}$. What is the minuend?

11. What number divided by $14\frac{5}{6}$ will give a quotient of 258?

12. What will $7\frac{1}{4}$ pieces of cloth cost, each piece containing 464 yd., if $\frac{3}{4}$ of a yard cost \$1.80?

13. How many acres are there in 3 lots containing respectively $19\frac{3}{5}$ acres, $28\frac{1}{3}$ acres, and $34\frac{7}{15}$ acres?

14. A boy rode $49\frac{1}{10}$ miles on his bicycle in two days. The first day he rode $31\frac{4}{5}$ miles. How many miles did he ride the second day?

15. A merchant bought cloth at \$$1\frac{7}{8}$ a yard and sold it at \$$2\frac{1}{4}$ a yard. What did he gain on 10 yards?

16. What will $8\frac{3}{4}$ bu. of peaches cost at \$$2\frac{1}{2}$ a bushel?

17. If a man earns \$$1\frac{4}{5}$ a day, how many days must he work to earn \$$73\frac{1}{5}$?

18. If $\frac{3}{4}$ of a barrel of apples cost \$$1\frac{1}{2}$, what will 8 barrels cost?

19. What number decreased by $\frac{1}{3}$ of itself equals 180?

20. What number increased by $\frac{1}{4}$ of itself equals 450?

1. How many apples must be cut up to give to each of 24 boys ⅔ of an apple?

2. If I buy stoves at $12 each, and sell them at 8⅓% profit, what shall I gain?

3. A horse was bought for $100, and sold for $95. What was the loss per cent?

4. A barrel of pork cost $12, and was sold for $11. What was the loss per cent?

5. A bought a horse for $150, and sold it for $180. What was his gain per cent?

6. B bought a horse for $100, and sold it for $109. What was his gain per cent?

7. Find the selling-price when the cost is $12, and the gain 12½%.

8. Find the selling-price when the cost is $15, and the loss is 66⅔%.

9. Find the selling-price when the cost is $2.50, and the gain 20%.

10. If 4 men can build a fence in 12 days, how many days will 9 men require?

11. The price of my coat was $12. I still owe 16⅔% of it. How much have I paid?

12. At 12½¢ a dozen, what will 4 doz. eggs cost?

13. At $6⅘ what will 10 bbl. of flour cost?

14. How many are 9 times 10¾?

15. What will 9¾ bbl. of vinegar cost at $4 a barrel?

16. If 1 gold pin costs $2⅔, how much will 6 cost at the same rate?

17. What will 8⅔ yd. of ribbon cost at 6¢ a yard?

18. A wagon was sold for $90, which was 5/4 of what it cost. How much did it cost?

19. What per cent of my money is ⅖ of it?

20. What per cent of any number is ⅜ of it?

1. About 10,000,000 bales of cotton are exported annually from the United States. If each bale is worth $30, find the value of our exported cotton.

2. 1,500,000 lb. of cotton are used in the cotton mills of Fall River. If the bales average 500 lb. each, how many bales are used annually in Fall River?

3. In California there is a vineyard of 5000 acres. If each acre produces 3 tons of grapes, how many pounds of grapes does the vineyard produce?

4. 30,000,000 gal. of wine are made in the United States each year. This is about $\frac{1}{50}$ of the amount produced in France. How many gallons are produced in France each year?

5. If 100 olive trees are placed on each acre, how many trees would there be in an orchard of 1200 acres?

6. If each olive tree produces 200 lb. of fruit, how many pounds would this orchard produce?

7. If it takes 8 lb. of olives to produce one quart of oil, how many gallons of oil will this orchard produce? How many quarts of oil will each tree produce?

8. When olive oil sells at $1.50 a gallon, find the value of the oil produced from the orchard.

9. The 600 wheat mills in Minnesota produce 30,000 barrels of flour a day. If $4\frac{1}{2}$ bushels of wheat make a barrel of flour, how many bushels of wheat are used daily in Minnesota?

10. If this flour is put into bags each bag holding $\frac{1}{8}$ of a barrel, how many bags will it take to hold the flour?

11. If a bag of flour at retail sells for $.80, what is the value of the flour?

12. Allowing 1 bbl. of flour annually to each person in the United States, how many bushels of wheat must be raised to supply the demand? Allow $4\frac{1}{2}$ bu. of wheat for 1 bbl. of flour.

13. If an acre of land produces 22 bu. of wheat, how many acres of wheat will it take to keep the mills in Minnesota running 300 days in the year?

Write in figures:

1. One thousand forty-one. **2.** Four and four tenths.

3. Four hundred thousand, four hundred and four hundredths.

Read the following:

4. 206,109 **5.** 110,080 **6.** 260,081.01

7. 70,006 **8.** 105,600 **9.** 17,024.005

Add:

10. $\begin{array}{r}77\\ \underline{54}\end{array}$ **11.** $\begin{array}{r}78\\ \underline{23}\end{array}$ **12.** $\begin{array}{r}95\\ \underline{77}\end{array}$ **13.** $\begin{array}{r}75\\ \underline{86}\end{array}$ **14.** $\begin{array}{r}48\\ \underline{55}\end{array}$

15. $\begin{array}{r}47\\ \underline{19}\end{array}$ **16.** $\begin{array}{r}92\\ \underline{69}\end{array}$ **17.** $\begin{array}{r}66\\ \underline{88}\end{array}$ **18.** $\begin{array}{r}25\\ \underline{78}\end{array}$ **19.** $\begin{array}{r}86\\ \underline{59}\end{array}$

Subtract:

20. $\begin{array}{r}86\\ \underline{55}\end{array}$ **21.** $\begin{array}{r}96\\ \underline{47}\end{array}$ **22.** $\begin{array}{r}83\\ \underline{26}\end{array}$ **23.** $\begin{array}{r}64\\ \underline{48}\end{array}$ **24.** $\begin{array}{r}87\\ \underline{49}\end{array}$

25. $\begin{array}{r}69\\ \underline{47}\end{array}$ **26.** $\begin{array}{r}77\\ \underline{38}\end{array}$ **27.** $\begin{array}{r}95\\ \underline{78}\end{array}$ **28.** $\begin{array}{r}64\\ \underline{36}\end{array}$ **29.** $\begin{array}{r}48\\ \underline{19}\end{array}$

Multiply:

30. $\begin{array}{r}75\\ \underline{2}\end{array}$ **31.** $\begin{array}{r}62\\ \underline{5}\end{array}$ **32.** $\begin{array}{r}42\\ \underline{6}\end{array}$ **33.** $\begin{array}{r}59\\ \underline{4}\end{array}$ **34.** $\begin{array}{r}48\\ \underline{3}\end{array}$

Divide:

35. $4\overline{)64}$ **36.** $5\overline{)125}$ **37.** $3\overline{)96}$ **38.** $7\overline{)287}$ **39.** $9\overline{)549}$

Change:

40. To fourths: $\frac{1}{2}$, $\frac{4}{8}$, $\frac{3}{12}$, $\frac{8}{16}$.

41. To sixths: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{2}{3}$, $\frac{2}{12}$, $\frac{6}{12}$, $\frac{6}{18}$.

42. To whole or mixed numbers: $\frac{18}{7}$, $\frac{18}{6}$, $\frac{14}{8}$, $\frac{17}{8}$.

43. To improper fractions: $3\frac{5}{6}$, $4\frac{2}{3}$, $7\frac{1}{2}$, $6\frac{3}{4}$.

44. Add: $\frac{5}{6}$ and $\frac{1}{3}$. **45.** $\frac{2}{3}+\frac{1}{4}=$——.

46. $\frac{5}{6}-\frac{1}{3}=$——. **47.** $\frac{2}{3}-\frac{1}{4}=$——.

1. 300,000,000 tons of coal are mined annually in Pennsylvania A ton of coal measures about 36 cu. ft. How many cubic feet are mined each year?

2. About $300,000,000 worth of gold is mined each year. The corn crop in one year is valued at about $850,000,000. How many times larger than the value of gold production is the value of the corn crop?

3. A western ranch man keeps 1000 head of cattle. He estimates that he needs 20 acres for each animal. How large a ranch does he need?

4. There are 800,000 acres in the state of Rhode Island. How many ranches as large as the one in example 3 could be made from the state of Rhode Island?

5. It is estimated that 1½ billion pounds of butter are made annually. What is its value at 25¢ a pound?

6. From the table of statistics in your geography find the total population of the New England States.

7. How much greater is the population of New York than that of the New England States?

8. Find the total area of the New England States.

9. Find the population per square mile for each of the New England States. Find the same for New York.

10. How many states the size of Rhode Island could be made from the state of Texas?

11. In 1900 the school expenditure in New York city was $21,040,810. The number of pupils in school that year was 559,218. What was the average cost for each pupil?

12. Cuba contains 45,884 sq. mi. and California, 158,360 sq. mi. How many times larger is California than Cuba?

13. In a certain year Cuba produced 880,372 tons of sugar. How many pounds did it produce? What was the average number of pounds produced per acre?

14. At 4½¢ a pound find the value of the sugar produced in Cuba in one year.

1. For what does A.M. stand? For what does P.M. stand?

2. Read: 7.10 P.M. 2.30 P.M. 9.15 A.M.

3. Train No. 11 leaves Boston daily at 4.00 P.M. It is due in Springfield at 6.16 P.M. How long does it take the train to pass between these two cities?

4. A train leaves one city at 10.00 P.M. and reaches another city at 2.00 A.M. How long does it take?

5. A train leaving Albany at 12 M. reaches Syracuse at 3.40 P.M. How long does it take to make that journey?

6. How many hours are there in a day?

7. What does 12 M. mean?

8. How many hours are there before noon in each day? How many after noon?

9. How many hours are there from noon to midnight?

10. How many hours are there from 6 A.M. to 6 P.M.?

11. How many hours is school in session in the forenoon? In the afternoon? In the day?

12. Banking hours are from 9 A.M. to 3 P.M. How many hours is that? What part of the day is it?

13. Write the Roman numerals as they appear on the clock dial.

14. In what other way is IIII written?

15. A train leaves Albany at 4.15 A.M. It is due in Pittsfield in one hour and thirty minutes. When is it due in Pittsfield?

16. A train leaving Boston at 1.45 is due in Albany in 6 hours. When is the train due in Albany?

17. A train leaves one station at 11 A.M. and reaches another station 105 miles distant at 2 P.M. How many miles an hour did the train move?

18. A train leaves Portland at 12.10 P.M. on the Western Division and reaches Boston at 3.25 P.M. On the Eastern Division a train leaves at 12.15 P.M. and arrives at 3.40 P.M. How much longer does it take one train than the other?

NEW HAVEN TO BOSTON

Miles	Stations	72	606	22
		A.M.	A.M.	P.M.
0	New Haven	2.55	7.47	4.53
51	New London	4.05	9.40	6.00
113	Providence	5.50	11.50	7.26
158	Boston	7.15	1.20	8.30

1. How many miles is it from New Haven to Providence? To Boston?

2. How many miles is it from New London to Boston? From Providence to Boston?

3. Each train is numbered. Read the time table for train 72. For 606. For 22.

4. How long does it take train No. 72 to go from New Haven to Boston?

From 2.55 A.M. to 3 A.M. is 5 min.
From 3.00 A.M. to 7.15 A.M. is 4 hr. 15 min.
4 hr. 15 min. and 5 min. are 4 hr. 20 min.

5. Train No. 606 is called an accommodation train and stops at many stations not on this time table. How long does it take this train to go from New Haven to Boston?

6. How much longer does it take train No. 606 to make the trip than train No. 72?

7. In how much shorter time does train No. 22 make the trip than train No. 72?

8. How long does it take train No. 72 to go from New Haven to New London? About how many miles an hour is that?

9. Train No. 21 leaves Boston at 3.00 P.M. It makes the trip in 3 hr. 37 min. When is it due in New Haven?

10. A train leaves Boston at 5.00 P.M. and reaches another city 75 miles distant at 7.00 P.M. What is the average speed an hour?

11. Another train leaves Boston at 6.25 A.M. and reaches the same city at 9.10 A.M. What is the difference in the running time of the two trains?

1. Name the seven letters used by the Romans in writing numbers.

2. Give the value of these seven letters.

3. V = 5. IV = 4. Notice that when a letter is preceded by a letter of less value than itself the number denoted by the expression is the *difference* of their values.

4. Express 9 as 10 less 1. Express 90 as 100 less 10. Express 40 as 50 less 10.

5. V = 5. VI = 6. Notice that when a letter is followed by another of equal or less value the number expressed is the *sum* of their values.

6. Express 11 as 10 and 1. Express 60 as 50 and 10. Express 70 as 50 and 10 and 10.

7. Name the letters that stand for the numbers from 1 to 10.

8. Name the letters that stand for 20, 30, 40, 50, 60, 70, 80, 90, 100.

9. Tell in each case which rule applies.

10. Name the letters that stand for the numbers between 20 and 30.

11. Read: XI; XII; XV; XVI; XVIII.

12. Name the letters that stand for 73; 65; 81.

13. XIV = 14. When a letter is placed between two letters, each of greater value, its value is *subtracted from the sum of the other letters* to find the value of the expression.

14. For what does XIX stand. For what does CXL stand?

15. For what does D stand? C? X? For what does DCX stand? For what does DXC stand?

16. L + X + V = ——. **17.** L + X + X + V + I = ——.

18. State the rule that applies to the value of CD. That applies to DC.

19. State your age in Roman numerals.

20. For what does DCCCC stand? For what does CM stand? What rule applies to each of these numbers?

1. What is the value of DC? CD?

2. Express in Roman numerals: 27, 81, 96, 101, 530, 300, 406, 135, 276, 120, 412, 735.

3. Read: XLVII, LXXIX, XCIV, CX.

4. *Express in Roman numerals:*
532, 280, 146, 377, 48, 600, 762, 805, 1876.

5. *Read the following:*
CLXVI. CCCXLIII. CCLXXXVII. MCM. MCXXIX.

Express in Roman characters:

6. 16, 23, 42, 51, 67, 72, 89, 91.

7. 156, 204, 560, 478, 892, 999, 312, 463.

8. What does M stand for? Then what does MDC stand for?

9. *Express in Roman notation:*
1286, 1776, 1896, 1909, 1492.

Express in Arabic notation:

10. XLV, CCCV, MM, DXC, MMD.

11. LXV, XLVI, XCIV, XCIX, LXXXIX.

12. CIX, DLIV, MDCI, MXCV, MDCCCIX.

13. XCI, CMVI, MCDX, CCXC, DCCXLIX.

14. DCXC, DCCX, CLXXV, XXIX, CCCCXLVIII.

15. Write 400 in Roman notation in two different ways.

16. Write the seven letters used in Roman notation with their values.

17. State the rule when a letter is followed by another letter of equal or less value.

18. State the rule when a letter is followed by another letter of greater value.

19. Is there any difference between MDCCCCXI or MCMXI? Which is the better form?

20. The Roman notation is used chiefly for numbering chapters and for dates.

Review Lessons 10, 11.

1. What is division?

2. Name the terms used in division.

3. When is the quotient an abstract number? When is it like the dividend?

4. What is the proof for an example in division?

5. Make an example in division, the answer to which must be an abstract number.

6. Express 9 divided by 3 in three ways.

7. What is the sign for division and how is it read?

Divide and check your results. See how many examples you can do correctly in ten minutes:

8. 302,976 by 384
9. 768,435 by 482
10. 768,372 by 231
11. 639,875 by 408
12. 836,424 by 638
13. 815,707 by 763
14. 782,582 by 758
15. 719,904 by 486
16. 465,213 by 1000
17. 175,166 by 1000
18. 216,144 by 200
19. 234,432 by 900
20. 975,000 by 500
21. 482,400 by 240

22. A number of lots at $125 each was sold for $36,375. How many lots were sold?

23. The dividend is one hundred twenty thousand eight hundred forty and the divisor is two hundred sixty-five. What is the quotient?

24. The multiplier is 253 and the product is 930,534. What is the multiplicand?

25. A man bought 76 acres of land for $9120. How much did it cost an acre?

26. The United States with an area of 3,688,110 sq. m. has a population of 76,212,168. How many inhabitants does it average to a square mile?

Review Lessons 21, 22, 23.

1. What do we call an expression like $\frac{5}{6}$?

2. What is a fraction?

3. In the expression $\frac{5}{6}$, what do we call the 6, and what does it tell us?

4. What do we call the 5, and what does it tell us?

5. What do we call such an expression as $12\frac{1}{2}$?

Change the following to their lowest terms:

6. $\frac{48}{144}$ **7.** $\frac{125}{500}$ **8.** $\frac{48}{240}$ **9.** $\frac{98}{294}$ **10.** $\frac{68}{108}$

Change the following to some higher term:

11. $\frac{1}{2}$ **12.** $\frac{2}{3}$ **13.** $\frac{3}{4}$ **14.** $\frac{5}{6}$ **15.** $\frac{7}{8}$.

Change to whole or mixed numbers:

16. $\frac{65}{9}$ **17.** $\frac{46}{8}$ **18.** $\frac{81}{6}$ **19.** $\frac{147}{12}$ **20.** $\frac{175}{8}$

Change to improper fractions:

21. $7\frac{5}{6}$ **22.** $19\frac{2}{3}$ **23.** $46\frac{7}{8}$ **24.** $31\frac{4}{5}$ **25.** $81\frac{3}{4}$

26. What change must be made in such fractions as $\frac{1}{2}$ and $\frac{1}{3}$ before they can be added or subtracted? Give their sum and difference.

Find the sum of:

27. $7\frac{2}{3}$, $9\frac{1}{4}$, $17\frac{1}{2}$. **28.** $10\frac{7}{8}$, $17\frac{3}{4}$, $19\frac{2}{3}$.

29. $\begin{array}{r} 763\frac{1}{3} \\ 418\frac{1}{6} \\ \underline{375\frac{1}{2}} \end{array}$ **30.** $\begin{array}{r} 125\frac{3}{4} \\ 449\frac{1}{8} \\ \underline{228\frac{1}{2}} \end{array}$ **31.** $\begin{array}{r} 545\frac{5}{6} \\ 828\frac{2}{3} \\ \underline{319\frac{1}{2}} \end{array}$ **32.** $\begin{array}{r} 252\frac{7}{8} \\ 196\frac{2}{3} \\ \underline{324\frac{5}{6}} \end{array}$

Find the difference between:

33. $\frac{3}{8}$ and $\frac{1}{6}$ **34.** $\frac{4}{5}$ and $\frac{3}{4}$ **35.** $\frac{1}{2}$ and $\frac{2}{3}$ **36.** $\frac{2}{3}$ and $\frac{3}{5}$

37. $\begin{array}{r} 218\frac{1}{3} \\ \underline{109\frac{3}{5}} \end{array}$ **38.** $\begin{array}{r} 289\frac{1}{5} \\ \underline{148\frac{3}{4}} \end{array}$ **39.** $\begin{array}{r} 720\frac{2}{3} \\ \underline{187\frac{3}{4}} \end{array}$ **40.** $\begin{array}{r} 301\frac{1}{9} \\ \underline{184\frac{1}{6}} \end{array}$

41. One force of $37\frac{1}{2}$ lb. is pulling an object toward the right and another force of $28\frac{3}{4}$ lb. is pulling the object toward the left. How much greater is the force to the right, that is, what is the joint effect of the two forces?

Review Lessons 45 to 47:

1. *a.* Divide $\frac{4}{5}$ by 2. *b.* Divide $\frac{2}{3}$ by 3.

2. State the rule that applies to *a*, for dividing a fraction by an integer. State the rule that applies to *b*.

Divide:

3. $\frac{12}{15}$ by 6 **4.** $\frac{10}{12}$ by 5 **5.** $\frac{12}{16}$ by 4
6. $\frac{3}{4}$ by 4 **7.** $\frac{4}{5}$ by 5 **8.** $\frac{7}{8}$ by 3
9. $15\frac{5}{6}$ by 5 **10.** $24\frac{6}{7}$ by 6 **11.** $54\frac{9}{10}$ by 9
12. $625\frac{2}{5}$ by 3 **13.** $764\frac{1}{2}$ by 7 **14.** $568\frac{2}{7}$ by 9

15. Find $\frac{1}{3}$ of $\frac{1}{2}$. This means divide $\frac{1}{2}$ into 3 equal parts. This is commonly called *multiplying a fraction by a fraction.*

16. Find $\frac{2}{3}$ of $\frac{5}{6}$. This means divide $\frac{5}{6}$ into 3 equal parts and take 2 of those parts. Find the answer.

17. Dividing $\frac{3}{4}$ into 5 equal parts is finding what fractional part of $\frac{3}{4}$?

18. How do you multiply a fraction by a fraction?

Multiply, using cancellation when possible:

19. $\frac{3}{4}$ by $\frac{8}{9}$ **20.** $\frac{7}{8}$ by $\frac{4}{5}$ **21.** $\frac{3}{4}$ by $\frac{7}{9}$
22. $2\frac{1}{2}$ by $3\frac{1}{5}$ **23.** $3\frac{1}{4}$ by $2\frac{1}{3}$ **24.** $3\frac{1}{2}$ by $6\frac{2}{3}$
25. $15\frac{3}{4}$ by $8\frac{1}{2}$ **26.** $12\frac{2}{3}$ by $12\frac{1}{4}$ **27.** $25\frac{2}{7}$ by $9\frac{1}{3}$
28. $245\frac{1}{2}$ by $16\frac{3}{4}$ **29.** $207\frac{1}{3}$ by $14\frac{5}{6}$ **30.** $214\frac{1}{4}$ by $12\frac{1}{2}$

31. Find the cost of $17\frac{1}{2}$ lb. of sugar at $5\frac{7}{8}$¢ a pound?

32. A man owned $\frac{2}{3}$ of a mill and sold $\frac{3}{5}$ of his share. What part of the mill did he sell? What part does he still own?

33. At \$$1\frac{1}{8}$ a yard, how much will $12\frac{3}{4}$ yd. of carpet cost?

34. Find the area of a surface $44\frac{6}{7}$ ft. by $28\frac{3}{4}$ ft.

35. Find the cost of $24\frac{3}{4}$ doz. eggs at $16\frac{1}{3}$¢ a dozen.

36. A cubic foot of water weighs $62\frac{1}{2}$ lb. What will be the weight of water in a tank 6 ft. long by $4\frac{1}{2}$ ft. wide by $3\frac{1}{3}$ ft. deep?

37. What must be added to $17\frac{7}{12}$ to make $69\frac{1}{3}$?

38. What must be taken from $23\frac{1}{8}$ to leave $8\frac{3}{16}$?

Review Lessons 48, 49.

Divide:

1. 33 by 5½
2. 75 by 12½
3. 100 by 3⅓
4. 63⅓ by ⅚
5. 60⅓ by ¾
6. 55⅛ by 4½

7. If a boat sailed 302½ miles in 2½ days, how far did it sail in a day?

8. When flour is $5¼ a barrel how many barrels can be bought for $147?

9. A man put 20⅚ bu. of grain into bags holding 1⅓ bu. How many bags did he need?

10. The product of two numbers is 5⅐. One of the numbers is 4½. Find the other number.

11. If 20⅝ cords of wood cost $115½, what is the price of one cord?

12. A lot containing 2⅗ acres was divided into four equal parts. What part of an acre was in each part?

13. How many barrels of Portland cement at $2¾ a barrel can be bought for $27½?

14. A sidewalk is 850½ ft. long. If a flagstone is 2⅝ ft. long, how many stones will it take to reach the length of the walk?

15. A field contains 2180⅛ sq. rd. If one side is 40¾ rd. long, how long is the other side?

16. A man paid $49⅗ for coal at $7¾ a ton. How many tons did he buy?

17. A farmer sold 45½ bu. of wheat for $36⅖. What price did he receive for each bushel?

18. A merchant made a profit of $45.75 on 61 yd. of velvet. How much did he gain on each yard? If he sold it at $1.60 a yard how much did it cost him?

19. $12\frac{1}{2} \times 8\frac{1}{3} \div 6\frac{1}{4} =$ ——.
20. $16\frac{2}{3} \div 37\frac{1}{2} \times 6\frac{7}{8} =$ ——.

21. A boy is riding his bicycle at the rate of a mile in ⅕ of an hour, how many miles will he travel in 3 hr. 24 min? In 2 hr. 48 min?

1. 6 is $\frac{1}{3}$ of what number? 4 is $\frac{1}{2}$ of what number?

2. $\frac{1}{6}$ is $\frac{1}{3}$ of what? $\frac{1}{4}$ is $\frac{1}{2}$ of what?

3. A man can do $\frac{1}{4}$ of a piece of work in $\frac{1}{2}$ of a day. How long will it take him to do the whole work?

4. A man can do $\frac{1}{2}$ of a piece of work in $\frac{1}{4}$ of a day? In what time can he do the whole work?

5. A man sold a horse for $\frac{3}{5}$ of the cost and lost $40. How much did the horse cost? How much did he receive for him?

6. By uniting two rectangles 8$\frac{1}{2}$ in. long and 4$\frac{1}{2}$ in. wide, what two other rectangles could you make?

7. How many half-inch squares are there in a sheet of paper 5 in. long and 2$\frac{1}{2}$ in. wide?

8. A man sold $\frac{3}{4}$ of his apples and had 50 bbl. left. How many barrels did he sell?

9. A merchant sold $\frac{3}{4}$ of a yard of ribbon from a piece containing 2$\frac{1}{4}$ yd. What part did he sell? $\frac{3}{4}$ is what part of 2$\frac{1}{4}$?

10. A man bought a suit of clothes for $36, which was $\frac{4}{7}$ of his money. How much money had he left?

11. $\frac{1}{9}$ of a yard is $\frac{1}{6}$ of how many inches?

12. $\frac{1}{4}$ of a foot is $\frac{1}{3}$ of how many inches?

13. A merchant received $15 for silk sold at 1\frac{1}{4}$ a yard. If he sold $\frac{1}{3}$ of the piece of silk, how many yards were there in the piece?

14. Compare $\frac{1}{2}$ of a foot with $\frac{1}{3}$ of a yard.

15. Compare $\frac{1}{2}$ of a quart with $\frac{1}{4}$ of a gallon.

16. Add $\frac{1}{2}$ ft. and $\frac{1}{3}$ ft. Give the answer in both inches and fraction of a foot.

17. If $\frac{2}{5}$ of a piece of land is worth $400, how much is the rest of the piece worth?

18. Find the cost of 6 pounds of rice at 8$\frac{3}{4}$ cents a pound.

19. What is the value of $\frac{3}{4}$ of a bushel of potatoes, when potatoes are worth 25 cents a peck?

1. If $7.35 is $\frac{1}{4}$ of a man's money, how much can he spend and have $\frac{1}{3}$ of his money left?

2. A man sold a piece of land for $250 and lost $\frac{2}{7}$ as much as it cost. How much did it cost? How much did he lose?

3. A man paid $1250 for flour at $5 a barrel. If he sold it at $\$5\frac{3}{4}$ a barrel, how much did he gain?

4. If $\frac{4}{5}$ of a ton of coal cost $5.80, how much are $7\frac{1}{2}$ tons worth?

5. A man received $12 for selling $\frac{1}{4}$ of his strawberries at 8¢ a basket. How many baskets has he left?

6. A farmer spent $\frac{1}{9}$ of his money for a horse. How many more horses can he buy at the same price and have $\frac{2}{3}$ of his money left?

7. A merchant places a value of $680 on $\frac{2}{3}$ of his stock. At the same valuation what is the worth of $\frac{3}{4}$ of the stock?

8. A man sold $\frac{1}{3}$ of his wheat for $260.25. At the same price, what is one half of the remainder worth?

9. A boy spent $\frac{3}{5}$ of his money and had $20.60 left. How much did he spend?

10. A man bought 6000 bu. of grain at $.66 a bushel. He sold $\frac{1}{4}$ of it at $.72 a bushel, $\frac{1}{5}$ of it at $.64 a bushel and the remainder at $.78 a bushel. How much did he gain?

11. A dealer sold some goods for $723.42 and gained $\frac{2}{7}$ as much as they cost. Find the cost and the gain.

12. A man sold $\frac{1}{2}$ of his farm to one man, $\frac{1}{3}$ to another, and had 27 acres left. How many acres did he sell?

13. A piece of land contains $14\frac{2}{5}$ sq. rd. If the piece is $5\frac{1}{7}$ rd. long, how wide is it?

14. If a distance of 10 ft. is represented by a line $1\frac{1}{5}$ in. long, what is the scale of drawing? What would it be if represented by a line $\frac{2}{5}$ in. long?

15. A rectangular field is 120 rd. long. If its width is $\frac{7}{8}$ of its length, find its width. Find the cost of fencing the field at $1.75 a rod.

Review Lessons 30, 31, 32, 64, 65.

1. Read: 106.106; 100.01; 6.0036.

2. Write: four and two hundredths; thirty-two and four thousandths; one hundred two and four hundred six ten-thousandths; two hundred two thousandths; two hundred and two thousandths.

3. Name the third place at the right of unit's figure.

4. Name the sixth place at the right of unit's figure.

5. 2.22. In this number how does the second 2 at the right of unit's figure compare in value with the unit's figure?

6. Read 4.06 (1) as a mixed decimal, (2) as hundredths.

7. $.16\frac{2}{3}$. An expression like this is called a *Complex Decimal.* It consists of a decimal and common fraction united.

8. Add 56.7, 4.05, 236.542, 41.6, 5,625, .25, 710.2.

9. Add four and two tenths, sixty-four and fifty-eight hundredths, two hundred five and twenty-four thousandths.

10. From 9.4 take .765.

11. Take .7504 from 5.15.

12. Give the rule for changing a common fraction to the decimal form.

13. Express as decimals: $\frac{1}{8}$, $\frac{3}{16}$, $\frac{13}{20}$, $\frac{3}{400}$.

14. How do you change decimals to common fractions?

15. Change to common fractions: .16, .125, .072.

16. Add $\frac{1}{8}$, .75, $\frac{4}{5}$, .06, $\frac{3}{25}$. Give the answer as a decimal and then change it to a common fraction.

17. Find the difference between .00025 and .0015.

18. What is a decimal fraction, more often called simply a decimal?

19. How is the decimal point usually read?

20. Read .475 (1) as tenths and fraction of tenths, (2) as hundredths and fraction of hundredths, (3) as thousandths.

21. Which figure of the decimal gives the name to the decimal?

Review Lessons 33, 59, 60.

1. Multiply 4.28 by 57. **2.** $52.4 \times 18 =$.

3. Divide 1450.8 by 18. **4.** $3.4408 \div 34 =$.

5. Multiply 3.6 by .7.

6. What does example 5 mean? How do you find $\frac{1}{10}$ of 3.6? If .36 is .1, how do you find .7?

7. Give the rule for finding $\frac{1}{10}$ of any decimal.

8. Moving the decimal point one place to the left is the same as dividing by what?

9. Give the rule for multiplying a decimal by a decimal.

Multiply:

10. 60.7 by 7.08 **11.** 40.15 by 7.02

12. 7.16 by 30.3 **13.** 7.225 by .036

14. 72.4 by .007 **15.** 301.5 by 5.06

16. .0085 by 9.36 **17.** 3048 by 7.12

18. How do you multiply a decimal by 10? By 100? By 1000?

19. If you multiply both divisor and dividend by the same number, how will it affect the quotient?

20. Give the rule for dividing by a decimal.

Divide:

21. 11.04 by 6.4 **22.** 31.3 by 5.008

23. .387 by .45 **24.** 9.6 by .006

25. 5.58 by .018 **26.** 2.46 by .012

27. If a man receives $1.40 for .4 of a day's work, how much ought he to receive, if he works 4.5 days?

28. Find .17 of $325.

Find the quotients to 3 decimal places:

29. $11.5 \div 3.33$ **30.** $6.25 \div 3.36$

31. $36.96 \div .008$ **32.** $.5 \div .007$

33. $1.04 \div 9.09$ **34.** $6.7 \div .09$

Review Lessons 66, 67, 68.

1. Change the following decimals to common fractions: .25, .75, .12½, 37½, .62½, .87½.

Multiply:

2. 48 by .25 **3.** 36 by .75 **4.** 32 by .12½

5. 400 by .37½ **6.** 240 by .62½ **7.** 800 by .87½

8. 72 by .75 **9.** 56 by .37½ **10.** 24 by .62½

11. Find the cost of 80 yd. of ribbon at $.25 a yard.

12. How much did a merchant receive for 40 yards of velvet sold at .75 a yard?

13. If 1 yd. of cotton cloth costs $.12½, what will 32 yards cost?

Multiply:

14. 60 by 1.25 **15.** 48 by 1.75 **16.** 48 by 1.12½

17. 50 by 2.50 **18.** 16 by 2.25 **19.** 56 by 1.37½

20. $1.25 by 12 **21.** 3.25 by 24 **22.** $2.50 by 16

23. Change the following common fractions to decimals: $\frac{1}{5}$, $\frac{1}{6}$, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{5}{6}$, $\frac{1}{3}$.

Find the cost of:

24. 30 articles at $.20 **25.** 42 lb. meat at $.16⅔

26. 60 articles at $.66⅔ **27.** 50 books at $.60

28. 66 articles at $.83⅓ **29.** 27 lb. butter at $.33⅓

30. How many articles costing $.16⅔ each can you buy for $4? $5½? $20? 80? $6½?

31. How many articles costing $.25 each can you buy for $1.25? $2.50? $5? $6? $3¾?

32. How many articles costing $.50 each can you buy for $3? $12? $7? $10½? $44½?

33. How many chairs at $1.33⅓ each, can be bought for $40? For $80? For $20?

34. Find the cost of 18 yd. of silk at $1.33⅓ a yard. Of 24 yd. Of 9 yd.

1. .25 of a yard is how many inches?

2. .33⅓ of 15 yd. is how many inches?

3. .66⅔ of 18 sq. ft. is how many square inches?

4. .75 of $1 is equal in value to how many cents?

5. If .62½ of a ton of coal cost $3.75, what will .75 of a ton cost?

6. If .25 of a cord of wood cost $1.35, what will .66⅔ of a cord cost?

7. If .33⅓ of a basket of peaches is worth 36 cents, what will 2.5 baskets cost?

8. A merchant had 5 bu. of walnuts and sold .87½ of them. How many quarts did he sell?

9. From the sum of .115, .0125, and .75 take .8575.

10. A merchant had 27.87½ yards of cloth in a piece. If he cut off 8.25 yd. at one time and 9.33⅓ yd. at another time, how many yards did he have left?

11. A man planted 27.5 acres of potatoes. Each acre produced 37.25 bu., which were sold at $.87½ a bushel.

a. How many bushels of potatoes were raised?

b. For how much were the potatoes sold?

12. If a boy earns $5.75 in 5 days, how much will he earn in 7.25 days?

13. Find the cost of :

a. 96 yd. of dress goods at $1.87½ a yard.

b. 92 yd. of silk at $1.75 a yard.

c. 144 yd. of velvet at $1.83⅓ a yard.

14. Find the difference between 1 and 3 hundredths and 4 and 15 thousandths.

15. Write as common fractions, .08⅓, .14$\frac{2}{7}$, .87½.

16. A bushel of potatoes contains 47.69 lb. water, 10.29 lb. starch, .56 lb. ash, 1.34 lb. proteid and .12 lb. fat. How much does a bushel of potatoes weigh?

17. Change .75 lb. to ounces.

Review Lessons 76 to 78.

1. Make a bill of five articles bought at a grocery store, using the form in Lesson 76.

2. Name the debtor and creditor in this bill.

3. Give the abbreviations for debtor and creditor.

4. What is the difference between the cost and price of the different articles in the bill you have written?

5. What is the total amount of the bill?

6. How do you as clerk receipt the bill?

7. Make out the bill, using the following items: John D. Baker bought of E. P. Judd Co., Dec. 1, Chambers' The Firing Line, $1.50, Johnston's Lewis Rand, $1.50; Dec. 10, Jenks' Photography for Young People, $1.67, Hough's The Young Alaskans, $1.25.

In the following bills use reasonable quantities and market prices. Make yourself the debtor and some store in the neighborhood the creditor.

8. Make out a bill of groceries.

9. Make out a bill of goods bought at the nearest fish market.

10. Make out a bill of goods bought at the nearest fruit store.

11. Make out a bill of dry goods.

12. Make out a bill of goods bought at a bakery.

13. Make out a bill of such goods as are bought at a book store.

14. Make out a bill for athletic goods.

15. What three things should each item of an account give?

16. Make out a bill from the following data: 2 lb. Mocha coffee at 32¢, 3 lb. crackers at 9¢, 12 bars Ivory soap at 4¢, 15 lb. graham flour at 3¢.

17. Supplying names and dates make out a bill for the following goods: 1 boy's suit $5.00, 1 boy's suit $6.50, 3 pairs of stockings at 25¢, 2 neckties at 35¢, 1 pair of rubbers 75¢, 1 doz. handkerchiefs 75¢.

Review Lessons 79 and 80.

1. Write the following as a time sheet account and find the money due each man, when 8 hr. is called a day's work:

Mr. Little at $2.25 a day worked 8 hr. a day on Monday, Wednesday, Friday and Saturday, 10 hr. Tuesday and was sick Thursday. Mr. Brown at $2.50 a day worked 10 hr. a day on Monday, Tuesday, Friday, and Saturday, and 8 hr. a day on Wednesday and Thursday. Mr. Warner at $3.00 a day worked 8 hr. a day on Tuesday, Wednesday, Friday and Saturday, and 9 hr. on Monday and 6 hr. on Thursday.

2. Rule paper as in Lesson 80 and write the following as a cash account, balancing the account on Dec. 10:

Cash on hand Dec. 1, $72.50. Received week's salary, $25, on Dec. 1, and Dec. 8. Paid, Dec. 1, for housework $16, groceries $1.10; Dec. 2, vegetables $.50, crullers $.20; Dec. 5, dressmaker $12.00, laundry $.94, Times 12¢, cloak $17.25; Dec. 7, meat bill $15.00, pair of rubbers $.75; Dec. 8, cream 10¢, groceries $1.60, cotton cloth, etc., $2.35, ribbon 44¢; Dec. 9, potatoes $1.00, shoes and socks $5.00, thread 15¢, pads and pencils $.31.

3. How do you balance an account?

4. Write the following as a cash account for a farmer:

Jan. 1, Amount on hand $95.75. Jan. 3, Received for vegetables and poultry, $37.50. Jan. 5, Paid for shoes, $4.50. Jan. 10, Paid for Algebra, $1.45. Jan. 20, Received for eggs, $5.75. Jan. 31, Paid for labor, $28.75.

5. Write the following transactions as Mr. Rogers' cash account: Cash on hand May 1, $250. May 2, Paid for insurance, $55. May 15, Received salary, $200. May 31, Paid household expenses, $87.50 and incidentals $13.75.

6. Write the following as a cash account for Mr. Blackmer:

Aug. 25, cash on hand $62.50. Received for labor, $7.35, for corn $.95, and for a fowl, $1.15. Aug. 26, paid for groceries, $7.35 and for doctor's bill, $5.65. Aug. 27, received for labor $3.25, for broilers $2.85 and for tomatoes $.96. Aug. 28, paid for suit of clothes $33.00.

1. A rectangular lot of land containing 2625 sq. ft. is 62½ ft. long. How wide is it?

2. If I buy 15 tons of iron at $31.75 a ton, and 48 tons at $39.35 a ton, what shall I gain by selling the whole at $41.15 a ton?

3. Divide 160,814.16 by 4000.

4. If 12 yd. of cloth cost $27, what is the cost of 8 yd. at the same rate? Do not find the cost of 1 yd.

5. What will it cost to dig a cellar 32 ft. long, 24 ft. wide and 6 ft. deep at $.27 a cubic yard? In this example what is the price of a cubic foot?

6. Reduce to improper fractions: $16\frac{5}{8}$, $44\frac{2}{5}$, $27\frac{3}{8}$, $14\frac{5}{9}$.

7. B's property is valued at $2500. If the rate of taxation is 1½%, what tax must B pay?

8. If 12 bu. of wheat cost $10.80, what will 25 bu. cost?

9. When iron is worth $33.50 a ton, what is the value of 15,640 pounds?

10. Find the cost of 25⅓ yd. of cloth at 12½¢ a yard.

11. A rectangular lot is 24 ft. long and 16 ft. wide. Find its area. If there was a walk 8 ft. wide round the outside of this lot, what would be the length and width of both lot and walk? Find the area of both lot and walk. How can you find the area of the walk? What is its area?

12. My garden is 36 ft. long and 24 ft. wide. Just inside the fence there is a walk 1½ ft. wide round the garden. Find the area of the walk as suggested in example 11. At 15¢ a running foot what will it cost to fence the garden?

13. Divide twelve thousandths by three ten-thousandths.

14. What will 175 lb. 8 oz. of sugar cost at 9¢ a pound?

15. In one school there should be 480 pupils. If only 95% are present, how many are absent?

16. I gave the grocer a $5 bill to pay for 5 lb. tea at $.62½ a pound and 5½ lb. of crackers at 9¢ a pound. Find my change.

17. At $¾ a yard, what will 19½ yd. of cloth cost?

1. What is notation?

2. What is numeration?

3. Why is our system of reading and writing numbers called the Arabic system?

4. Why is the system also called a decimal system?

5. Name the first six periods in order from right to left.

6. Name the three orders into which each period is divided.

7. Read 406,017,208,057,217,400,506.

8. Write in figures: sixty billion, four million, one hundred two thousand, nineteen.

9. From 41 take 29. Which is the subtrahend? Which is the minuend? What is the answer called?

10. Name the three terms used in multiplication. Which one must always be an abstract number?

11. How do you multiply any number by 10 or 100?

12. What is division?

13. Make a problem to illustrate each of the two uses of division.

14. Multiply 8,325,796 by 78,649.

15. Divide 23,531,408,064 by 24,768.

16. How many feet are there in 4428 inches?

17. How many pecks are there in 9 bu. 3 pk.?

18. In 19 lb. 14 oz. there are how many ounces?

19. What is the area of an oblong 5 in. by 7½ in.? What is the area of another oblong 3½ times larger than the first oblong?

20. On a lot 65 ft. by 160 ft. is a house 35 ft. by 40 ft. and a barn 18 ft. by 28 ft. How many square feet are there in the lot not covered by buildings?

21. How many square feet of concrete are required for a walk 75 ft. long and 4½ ft. wide?

22. What is the cost of fencing a rectangular field 24 rd. long and 19 rd. wide, if the fence costs $.87½ a rod?

1. What does the denominator of a fraction tell us?

2. How can you tell the denominator of a decimal?

3. Multiply 207.6 by .8.

4. Find the cubical contents of a room 18 ft. by 15.4 ft. by 9.5 ft.

5. $.28\frac{4}{7}$ of 7 weeks are how many days?

6. Find the cost of 24.75 lb. of meat at $.16 a pound.

7. Tell the easiest way to multiyly a decimal by 10. By 100. By 2000. By 50.

8. Before dividing a decimal by a decimal what should you first do to the decimal points?

9. Divide 32.08 by .05.

10. If a man travels 165.375 miles in 12.25 days, how far will he travel in one day?

11. A man paid $3200 for a house and sold it at a loss of $12\frac{1}{2}\%$. How much did he receive for the lot? How much would he have received if he had sold it at a gain of $12\frac{1}{2}\%$?

12. What is the effect upon the value of a fraction of:

- *a.* Multiplying the numerator of the fraction?
- *b.* Dividing the numerator of the fraction?
- *c.* Multiplying the denominator of the fraction?
- *d.* Dividing the denominator of the fraction?
- *e.* Multiplying or dividing both numerator and denominator of the fraction by the same number?

13. How is a fraction reduced to its lowest terms?

14. Multiply in two ways: $\frac{3}{4}$ by 2; $\frac{5}{12}$ by 6.

15. Divide in two ways: $\frac{5}{6}$ by 5, $\frac{2}{5}$ by 2.

16. *a.* Divide $12\frac{5}{6}$ by $8\frac{3}{4}$; *b.* Multiply $36\frac{3}{4}$ by $18\frac{2}{3}$.

17. After traveling 1305 miles, which was $\frac{5}{6}$ of a certain distance, an automobile broke down. Find the distance.

18. After spending $\frac{2}{5}$ of his money for a horse and $\frac{3}{8}$ of it for a carriage, a man had $36 left. How much money had he at first? How much did the horse cost?

SECTION II

LESSON 1. *ORAL REVIEW*

Add:

1. 7	**2.** 17	**3.** 27	**4.** 37	**5.** 47	**6.** 57
9	9	9	9	9	9

In examples like the following train the pupils to *think quickly* 17 and 9 are 26; 26 and 20 are 46, but to *say* 17 and 29 are 46. Give frequent practice in work of this kind.

7. 17	**8.** 37	**9.** 67	**10.** 77	**11.** 87	**12.** 97
29	19	39	49	59	69

Subtract:

13. 15	**14.** 25	**15.** 35	**16.** 45	**17.** 55	**18.** 65
8	8	8	8	8	8

In examples like the following train the pupils to *think quickly* 35 less 8 are 27; 27 less 10 are 17, but to *say* 35 less 18 are 17. Make charts for the purpose of giving frequent drill in *oral* addition and subtraction of tens and units.

19. 35	**20.** 75	**21.** 85	**22.** 95	**23.** 45	**24.** 65
18	18	38	48	28	38

Add and subtract:

25. 47	**26.** 41	**27.** 33	**28.** 72	**29.** 64	**30.** 81
31	19	18	48	57	46

1. At $.85 a bushel what is the value of 29 loads of potatoes, each load containing 35 bushels?

2. A butcher bought 64 sheep at $6.25 each, and others at $6.50 each. If he paid $679.50 for them all, how many sheep did he buy?

3. A merchant bought some oranges for $1870, and sold them for $2200, gaining 75 cents a box. Find the number of boxes and the cost of each.

4. A dealer gained $518 on 74 tons of hay, which he sold at $19.50 a ton. Find what the dealer paid a ton.

5. If 105 men can do a piece of work in 9 days, in how many days can 315 men do it?

6. The combined salary of A, B, C, D, and E is $9600. A's salary is $1400 and B's $1600. If C, D, and E receive the same salary, how much does each receive?

7. If a man pays $2160 for 24,000 pounds of copper, for how much a pound must he sell it to gain $480?

8. A dealer paid $13,500 for horses at $75 each and sold them at $98 each. If his expenses averaged $5 a horse, how much did he gain?

9. Find the average price of 5 suits of clothes costing $16.50, $17.50, $20, $22.50, and $27.50 respectively.

10. A merchant lost $3475 on goods which he sold for $15,725. How much would he have received for the goods if in selling them he had gained $2275?

11. Two ships are 578 miles apart. If they move toward each other, one 12 miles an hour and the other 9 miles an hour, how far apart will they be at the end of 24 hours?

12. A certain city pays 110 men $1375 for 5 days' work. What is the daily wages of each man?

13. A book agent bought 112 books at $3.20 each and sold them at $4.90 each. If his expenses were $75 and he could not collect the money for 4 books, did he gain or lose and how much?

1. What two numbers multiplied together give 9 as their product? Of what two numbers is 21 the product?

2. Numbers that multiplied together make a given number are called its **factors.** A **factor,** then, is a number that *exactly divides* another number.

3. **Factoring** is the process of separating a number into its factors. What are the factors of 27? 15? 20?

4. A **prime number** is a number that has no factors except itself and one, as 2, 3, 5, 7, 11, etc.

5. A **composite number** is a number that contains other factors, as 4, 6, 12, 15, etc.

6. A number is exactly divisible (can be divided):
By 2, if the units' figure is 0 or is divisible by 2.
By 3, if the sum of the digits is divisible by 3.
By 5, if the units' figure is 0 or 5.
By 9, if the sum of the digits is divisible by 9.

Find the prime factors of 132.

$$\begin{array}{r} 2\underline{)132} \\ 2\underline{)\ 66} \\ 3\underline{)\ 33} \\ 11 \end{array}$$

What prime number will divide 132? Dividing by 2, what is the quotient? What prime number will divide 66? Dividing again by 2, what is the quotient? What prime number will divide 33? Is the last quotient, 11, a prime number?

Test: 2 × 2 × 3 × 11 = 132. The prime factors of 132 are 2, 2, 3, 11.

Find the prime factors of:

7. 225 **8.** 891 **9.** 363 **10.** 1375
11. 567 **12.** 625 **13.** 288 **14.** 1728

15. Name some numbers that are divisible by 3. By 5.

16. Numbers that are divisible by other numbers are **multiples** of those numbers.

17. What is the smallest number that is divisible by both 3 and 5?

18. The least number that is divisible by each of several numbers is their **least common multiple.**

LEAST COMMON MULTIPLE AND GREATEST COMMON DIVISOR

LESSON 126

1. Find the least common multiple of 12 and 15.

A. $12 = 2 \times 2 \times 3$
$15 = 3 \times 5$
$2 \times 2 \times 3 \times 5 = 60$

We find that 2, 3, and 5 are the different factors. Since 2 is found twice in 12, it will be found twice in the least common multiple of 12 and 15.

B.

$$\begin{array}{r|rcr} 2 & 12 & - & 15 \\ \hline 2 & 6 & - & 15 \\ \hline 3 & 3 & - & 15 \\ \hline 5 & 1 & - & 5 \\ \hline & 1 & - & 1 \end{array}$$

Arrange the numbers as indicated. Divide by any prime number that will divide one or more. When a number is not divisible, bring it down without change. Continue to divide till the quotients are unity. The product of all the divisors will be the least common multiple.

Find the least common multiple of:

2. 24, 32, 72
3. 9, 24, 36
4. 6, 15, 48
5. 9, 15, 27
6. 36, 16, 24
7. 8, 14, 56

Greatest Common Divisor

8. Name some numbers that will divide 12. That will divide 15.

9. A number that will exactly divide another number is a **divisor** of the number.

10. Name the *largest* number that will exactly divide both 12 and 15.

11. The largest number that will exactly divide two or more numbers is their **greatest common divisor**.

12. Find the greatest common divisor of 24, 36.

$$\begin{array}{r|rcr} 2 & 24 & - & 36 \\ \hline 2 & 12 & - & 18 \\ \hline 3 & 6 & - & 9 \\ \hline & 2 & - & 3 \end{array}$$

$2 \times 2 \times 3 = 12$

Arrange the numbers as indicated. Divide by any prime factor that will divide both numbers. Divide the quotients by any factor that will divide both. Continue till there is no factor common to the quotients. The product of the divisors will be the greatest common divisor.

Find the greatest common divisor of:

13. 24, 36, 40
14. 15, 18, 27
15. 8, 16, 48
16. 32, 50, 64
17. 21, 48, 56
18. 18, 45, 90

Divide 30 by 15.

$30 = 2 \times 3 \times 5$

$15 = 3 \times 5$

$$\frac{30}{15} = \frac{2 \times \overset{1}{\cancel{3}} \times \overset{1}{\cancel{5}}}{\underset{1}{\cancel{3}} \times \underset{1}{\cancel{5}}} = 2$$

If we factor both numbers we find that 3 and 5 are factors of each number. Cross out or cancel the like factors in each number and 2 remains.

Cancelation is a method of shortening the work in division by rejecting equal factors. It is based on the principle that dividing both dividend and divisor by the same number does not change the quotient.

Divide 12 × 4 by 4 × 27.

$$\frac{\overset{4}{\cancel{12}} \times \cancel{4}}{\cancel{4} \times \underset{9}{\cancel{27}}} = \frac{4}{9}$$

The factor 4 is canceled from both dividend and divisor. The factor 3 is canceled from 12 in the dividend and from 27 in the divisor. The quotient is $\frac{4}{9}$.

Divide by cancelation:

1. 21 × 24 by 8 × 7

2. 42 × 35 by 49 × 20

3. 84 × 13 by 12 × 26

4. 48 × 20 by 36 × 10

5. $\dfrac{25 \times 12 \times 8}{10 \times 5 \times 11}$

6. $\dfrac{60 \times 48 \times 6}{30 \times 24 \times 12}$

7. $\dfrac{32 \times 14 \times 72 \times 50}{70 \times 64 \times 12 \times 15}$

8. $\dfrac{44 \times 8 \times 7}{11 \times 16 \times 7}$

9. $\dfrac{40 \times 18 \times 13 \times 8}{10 \times 13 \times 16 \times 2}$

10. $\dfrac{15 \times 4 \times 8 \times 9}{30 \times 2 \times 6 \times 12}$

11. What is the quotient of 88 times the product of 75 and 30, divided by 11 times the product of 25 and 24?

12. If 3 men can do a piece of work in 3 days, working 10 hours a day, how many days will it take 4 men, working 9 hours a day, to do the work?

13. A man worked for a farmer 8 weeks, 6 days a week, and received for his pay 16 sheep at $6 a sheep. Find his wages a day.

It is taken for granted at this time that the pupils are familiar with fractions. If the teacher finds that this is not the case, she should teach the definitions and processes now. For this purpose a few lessons are given for review.

1. What is a fraction?

2. What are the terms of a fraction called?

3. What does the numerator of a fraction show?

4. What does the denominator of a fraction show?

5. In the fraction, $\frac{2}{3}$, we think of a unit as divided into how many parts? What must be true of those parts?

6. In this same fraction we think of how many parts as being taken to form the fraction?

7. Tell the meaning of $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$, $\frac{9}{10}$.

8. Which term of the fraction numbers the parts?

9. Which term of the fraction names the parts?

10. What is a mixed number? Give an illustration.

11. What is an improper fraction? Give an illustration.

12. $\frac{1}{2}$ is equal to how many fourths? Sixths ? Eighths?

13. Changing $\frac{1}{2}$ to $\frac{3}{6}$, $\frac{4}{8}$, etc., is called changing a number to *higher terms.*

14. Multiply both terms of the fraction, $\frac{1}{2}$, by 2. What is the result?

15. $\frac{2}{4}$ = how many halves? Changing $\frac{2}{4}$ to $\frac{1}{2}$ is called changing a number to *lower terms.*

16. How do you change fractions to lower terms?

17. When is a fraction in its lowest terms?

18. Is $\frac{15}{7}$ a proper or an improper fraction! Why?

19. Change $\frac{12}{16}$ to eighths. Did you change to higher or lower terms?

20. Change $\frac{2}{3}$ to 24ths. Did you change to higher or lower terms?

21. Changing the form of a fraction without changing its value is called **reduction.**

1. We have learned that we may multiply or divide both numerator and denominator of a fraction by the same number without changing its value.

2. Apply this principle in changing $\frac{3}{4}$ to 24ths. By what must you multiply both numerator and denominator to change the fourths to 24ths?

Reduce:

3. $\frac{5}{12}$ to 48ths **4.** $\frac{7}{9}$ to 108ths **5.** $\frac{2}{3}$ to 96ths
6. $\frac{5}{6}$ to 120ths **7.** $\frac{11}{16}$ to 128ths **8.** $\frac{17}{18}$ to 162ds

Reduce $\frac{64}{216}$ to its lowest terms.

A. $\frac{2)64}{2)216} = \frac{2)32}{2)108} = \frac{2)16}{2)54} = \frac{8}{27}$

B. 8 = greatest common divisor of 64, and 216.

$$\frac{8)64}{8)216} = \frac{8}{27}$$

Use either form of solution and reduce to their lowest terms:

9. $\frac{250}{375}$ **10.** $\frac{216}{432}$ **11.** $\frac{225}{675}$ **12.** $\frac{96}{480}$ **13.** $\frac{108}{540}$
14. $\frac{17}{204}$ **15.** $\frac{804}{2412}$ **16.** $\frac{2472}{4350}$ **17.** $\frac{1236}{1472}$ **18.** $\frac{3672}{8168}$

Reduce $4\frac{1}{3}$ to thirds.

$4 \times \frac{3}{3} = \frac{12}{3}$
$\frac{12}{3} + \frac{1}{3} = \frac{13}{3}$

Since $1 = \frac{3}{3}$, 4 must equal 4 times $\frac{3}{3}$ or $\frac{12}{3}$. $\frac{12}{3}$ and $\frac{1}{3} = \frac{13}{3}$.

Reduce to improper fractions:

19. $87\frac{2}{3}$ **20.** $167\frac{4}{5}$ **21.** $27\frac{3}{4}$ **22.** $83\frac{1}{3}$ **23.** $75\frac{2}{5}$
24. $79\frac{9}{16}$ **25.** $42\frac{13}{15}$ **26.** $87\frac{7}{12}$ **27.** $32\frac{13}{18}$ **28.** $38\frac{17}{24}$

Reduce $\frac{43}{6}$ to a mixed number.

$$\frac{6)43}{7\frac{1}{6}}$$

Since $\frac{6}{6} = 1$ unit, there are as many units in $\frac{43}{6}$ as $\frac{6}{6}$ is contained times in $\frac{43}{6}$, that is $7\frac{1}{6}$. This is the same as dividing the numerator by the denominator, or performing the division expressed by the fraction.

Reduce to mixed numbers:

29. $\frac{476}{15}$ **30.** $\frac{271}{4}$ **31.** $\frac{84}{5}$ **32.** $\frac{381}{9}$ **33.** $\frac{465}{12}$

1. What kind of numbers can be added or subtracted?

2. Can you add 2 yd. and 24 in. without changing them? After changing each to feet can you add them?

3. What kind of fractions can be added or subtracted?

4. Can you add $\frac{1}{2}$ and $\frac{1}{3}$ without changing them?

5. $\frac{1}{2} = \frac{\ }{6}$ $\frac{1}{3} = \frac{\ }{6}$ $\frac{\ }{6} + \frac{\ }{6} = \frac{\ }{6}$

6. *Learn: Similar fractions are fractions having the same denominator. Fractions must be made similar before they can be added or subtracted.*

Find the sum of:

7. $\frac{3}{4}$ and $\frac{7}{8}$ **8.** $\frac{2}{3}$ and $\frac{5}{12}$ **9.** $\frac{4}{5}$ and $\frac{9}{10}$

10. $\frac{2}{3}$ and $\frac{5}{6}$ **11.** $\frac{3}{4}$ and $\frac{7}{12}$ **12.** $\frac{1}{3}$ and $\frac{7}{9}$

Find the difference between:

13. $\frac{3}{4}$ and $\frac{1}{2}$ **14.** $\frac{5}{6}$ and $\frac{5}{12}$ **15.** $\frac{2}{3}$ and $\frac{1}{6}$

16. $\frac{4}{5}$ and $\frac{3}{10}$ **17.** $\frac{5}{6}$ and $\frac{5}{9}$ **18.** $\frac{5}{7}$ and $\frac{3}{14}$

Add:

19. $\begin{array}{r} 4\frac{1}{2} \\ 3 \\ 5\frac{3}{4} \\ \underline{2\frac{1}{2}} \end{array}$ **20.** $\begin{array}{r} 3\frac{1}{3} \\ 4\frac{1}{2} \\ 5\frac{2}{3} \\ \underline{6\frac{1}{2}} \end{array}$ **21.** $\begin{array}{r} 5\frac{7}{8} \\ 3 \\ 6\frac{1}{4} \\ \underline{1\frac{1}{8}} \end{array}$ **22.** $\begin{array}{r} 2\frac{5}{6} \\ 7\frac{1}{2} \\ 2\frac{1}{4} \\ \underline{3\frac{1}{4}} \end{array}$

Subtract:

23. $\begin{array}{r} 7\frac{1}{2} \\ \underline{2\frac{1}{4}} \end{array}$ **24.** $\begin{array}{r} 5\frac{3}{4} \\ \underline{1\frac{1}{2}} \end{array}$ **25.** $\begin{array}{r} 8\frac{5}{6} \\ \underline{3\frac{1}{3}} \end{array}$ **26.** $\begin{array}{r} 4\frac{7}{8} \\ \underline{1\frac{1}{2}} \end{array}$

27. $\begin{array}{r} 5\frac{1}{3} \\ \underline{2\frac{1}{2}} \end{array}$ **28.** $\begin{array}{r} 6\frac{2}{3} \\ \underline{1\frac{5}{6}} \end{array}$ **29.** $\begin{array}{r} 8\frac{1}{4} \\ \underline{2\frac{1}{2}} \end{array}$ **30.** $\begin{array}{r} 7\frac{3}{8} \\ \underline{2\frac{3}{4}} \end{array}$

If the common denominator cannot be found by inspection, find the least common multiple of the denominators. (Lesson 126.)

1. Add: $8\frac{5}{6}$, $12\frac{7}{12}$, and $5\frac{2}{3}$

$$A.\quad \begin{array}{l|l}
 & 12 \\ \hline
8\frac{5}{6} & 10 \\
12\frac{7}{12} & 7 \\
5\frac{2}{3} & 8 \\ \hline
25 & \frac{25}{12} = 2\frac{1}{12} \\
2\frac{1}{12} & \\ \hline
27\frac{1}{12} &
\end{array}
\qquad\qquad
B.\quad \begin{array}{rcl}
8\frac{5}{6} & = & 8\frac{10}{12} \\
12\frac{7}{12} & = & 12\frac{7}{12} \\
5\frac{2}{3} & = & 5\frac{8}{12} \\ \cline{3-3}
 & & 25\frac{25}{12} = 27\frac{1}{12}
\end{array}$$

2. The sum of two numbers is $316\frac{7}{12}$. One of the numbers is $110\frac{3}{4}$. What is the other number?

3. A garden is in the form of a rectangle $112\frac{2}{3}$ ft. long and $79\frac{3}{4}$ ft. wide. What is the perimeter of the garden? How much does the length exceed the width?

4. A grocer sold $13\frac{1}{2}$ lb. of beef, $16\frac{3}{4}$ lb. of pork, and as many pounds of lamb as of the other two together. How many pounds did he sell in all?

5. A man's coal was delivered to him in three loads containing respectively $1\frac{1}{2}$ tons, $1\frac{3}{4}$ tons, and $1\frac{7}{8}$ tons. How many tons of coal were delivered to him?

Subtract:

6. $87\frac{5}{12} - 49\frac{5}{6}$ **7**. $41\frac{1}{3} - 17\frac{5}{6}$ **8**. $38\frac{1}{10} - 29\frac{1}{5}$

9. $71\frac{2}{5} - 27\frac{1}{4}$ **10**. $47\frac{3}{4} - 36\frac{1}{5}$ **11**. $73\frac{3}{8} - 56\frac{2}{3}$

12. $61\frac{1}{16} - 43\frac{3}{8}$ **13**. $53\frac{3}{5} - 27\frac{2}{3}$ **14**. $41\frac{3}{16} - 24\frac{1}{8}$

15. A merchant had $33\frac{1}{3}$ yd. of muslin. He sold $12\frac{1}{2}$ yd. to one woman, $9\frac{3}{4}$ yd. to another, and $7\frac{1}{8}$ yd. to another. How many yards did he have left?

16. $78\frac{5}{6} - 49\frac{3}{4} =$ **17**. $4\frac{1}{2} + 5\frac{2}{3} + 7\frac{5}{6} =$

18. A man having \$$45\frac{3}{4}$ received \$$24\frac{9}{10}$ for work, and then paid out \$$25\frac{1}{2}$. How much money had he left?

19. What number is $4\frac{1}{3}$ less than $7\frac{5}{9}$?

1. Multiply 12 by $\frac{2}{3}$.

$\frac{1}{3}$ of $12 = 4$
$\frac{2}{3} = 2 \times 4 = 8$

This means find $\frac{2}{3}$ of twelve. $\frac{1}{3}$ of $12 = 4$. $\frac{2}{3} = 2 \times 4 = 8$, or $12 \times \frac{2}{3} = \frac{24}{3} = 8$.

Learn: To multiply an integer by a fraction, multiply by the numerator and divide by the denominator.

Multiply:

2. 14 by $\frac{5}{7}$
3. $27 \times \frac{2}{3}$
4. $24 \times \frac{2}{9}$
5. 11 by $\frac{1}{2}$
6. $12 \times \frac{2}{5}$
7. $9 \times \frac{3}{4}$

8. Multiply $\frac{5}{6}$ by 2.

A. $\frac{5}{6} \times 2 = \frac{10}{6} = 1\frac{4}{6} = 1\frac{2}{3}$

B. $\frac{5}{\underset{3}{\cancel{6}}} \times \cancel{2} = \frac{5}{3} = 1\frac{2}{3}$

Use method *B* when the denominator exactly contains the integer.

Learn: To multiply a fraction by an integer, multiply the numerator by the integer or divide the denominator by the integer.

Multiply:

9. $\frac{7}{8}$ by 4
10. $\frac{9}{10}$ by 5
11. $\frac{5}{6}$ by 3
12. $\frac{2}{3}$ by 5

13. Multiply $\frac{1}{2}$ by $\frac{1}{3}$.

A. $\frac{1}{2} = \frac{3}{6}$, $\frac{1}{3}$ of $\frac{3}{6} = \frac{1}{6}$

B. $\frac{1}{2} \times \frac{1}{3} = \frac{1 \times 1}{2 \times 3} = \frac{1}{6}$

This means find $\frac{1}{3}$ of $\frac{1}{2}$. We may change $\frac{1}{2}$ to 3 sixths and then find $\frac{1}{3}$ of 3 sixths. But we see we obtain the same result by method *B*, hence the usual rule.

Learn: To multiply a fraction by a fraction, multiply the numerators together for the numerator, and the denominators together for the denominator. Use cancelation when possible to shorten the process.

Multiply:

14. $\frac{1}{2}$ by $\frac{4}{7}$
15. $\frac{2}{3}$ by $\frac{6}{8}$
16. $\frac{3}{4} \times \frac{5}{6}$
17. $\frac{2}{3}$ by $\frac{1}{6}$

1. Multiply $37\frac{5}{8}$ by 16.

$$\begin{array}{rcr} & & 37\frac{5}{8} \\ & & \underline{16} \\ 16 \times \frac{5}{8} & = & 10 \\ 16 \times 37 & = & \underline{592} \\ 16 \times 37\frac{5}{8} & = & 602 \end{array}$$

2. Multiply 61 by $9\frac{2}{5}$.

$$\begin{array}{rcr} & & 61 \\ & & \underline{9\frac{2}{5}} \\ & & 5\overline{)122} \\ \frac{2}{5} \times 61 & = & 24\frac{2}{5} \\ 9 \times 61 & = & \underline{549} \\ 9\frac{2}{5} \times 61 & = & 573\frac{2}{5} \end{array}$$

Multiply:

3. 75 by $8\frac{1}{3}$

4. 148 by $16\frac{2}{7}$

5. $66\frac{4}{5}$ by 18

6. 86 by $8\frac{4}{5}$

7. 235 by $36\frac{2}{3}$

8. $91\frac{7}{9}$ by 35

9. 63 by $7\frac{4}{7}$

10. 509 by $49\frac{4}{5}$

11. $56\frac{3}{7}$ by 28

12. Multiply $5\frac{2}{3}$ by $4\frac{3}{4}$.

$5\frac{2}{3} = \frac{17}{3}$. $\quad 4\frac{3}{4} = \frac{19}{4}$

$\frac{17}{3} \times \frac{19}{4} = \frac{323}{12} = 26\frac{11}{12}$

When both factors are mixed numbers they may be changed to improper fractions before multiplying.

Multiply:

13. $18\frac{5}{8}$ by $15\frac{5}{6}$

14. $42\frac{2}{3}$ by $21\frac{3}{5}$

15. $35\frac{3}{8}$ by $15\frac{3}{4}$

16. $75\frac{4}{7}$ by $36\frac{2}{3}$

17. $31\frac{2}{5}$ by $22\frac{2}{5}$

18. $71\frac{2}{3}$ by $51\frac{3}{4}$

19. $63\frac{4}{5}$ by $49\frac{5}{6}$

20. $52\frac{3}{4}$ by $21\frac{2}{7}$

21. $46\frac{3}{5}$ by $64\frac{2}{3}$

22. Find the cost of $27\frac{3}{8}$ cords of wood at \$$6\frac{1}{4}$ a cord.

23. What is the area of a rectangle $34\frac{5}{8}$ in. long and 21 in. wide?

24. A man sowed 48 acres of land with oats and $6\frac{7}{8}$ times as much with wheat. How many acres of wheat were there?

25. At the rate of $6\frac{5}{8}$ miles an hour, how far will a horse travel in $\frac{3}{4}$ of an hour?

26. At \$$\frac{7}{8}$ a yard, what will $7\frac{2}{3}$ yd. of silk cost?

1. Divide $\frac{3}{4}$ by 3.

$$A.\ \frac{3}{4} \div 3 = \frac{3 \div 3}{4} = \frac{1}{4}$$

$$B.\ \frac{3}{4} \div 3 = \frac{3}{4 \times 3} = \frac{3}{12} = \frac{1}{4}$$

A fraction may be divided by an integer by dividing the numerator by the integer or by multiplying the denominator by the integer. Use the first method whenever the numerator exactly contains the divisor.

Divide:

2. $\frac{5}{8}$ by 5

3. $\frac{6}{7}$ by 3

4. $\frac{3}{8}$ by 4

5. $\frac{6}{7}$ by 5

6. $\frac{4}{11}$ by 3

7. $\frac{5}{9}$ by 3

8. $\frac{3}{4}$ by 5

9. $\frac{9}{11}$ by 3

10. Divide 5 by $\frac{3}{4}$.

$5 = \frac{20}{4}$

$\frac{20}{4} \div \frac{3}{4} = 20 \div 3 = 6\frac{2}{3}$.

Change the integer to a fraction whose denominator is the same as that of the divisor, then divide the numerators.

Divide:

11. 4 by $\frac{2}{3}$

12. 5 by $\frac{3}{4}$

13. 8 by $\frac{5}{6}$

14. 6 by $\frac{8}{5}$

15. 9 by $\frac{1}{2}$

16. 7 by $\frac{2}{3}$

17. 5 by $\frac{2}{5}$

18. 3 by $\frac{4}{5}$

19. Divide $\frac{2}{3}$ by $\frac{3}{4}$.

$\frac{2}{3} = \frac{8}{12}$. $\frac{3}{4} = \frac{9}{12}$.

$\frac{8}{12} \div \frac{9}{12} = 8 \div 9 = \frac{8}{9}$.

Change both fractions to fractions having the same denominator, then divide the numerators.

Divide:

20. $\frac{7}{10}$ by $\frac{8}{5}$

21. $\frac{8}{12}$ by $\frac{3}{4}$

22. $\frac{5}{8}$ by $\frac{1}{4}$

23. $\frac{7}{10}$ by $\frac{1}{2}$

24. $\frac{5}{14}$ by $\frac{8}{7}$

25. $\frac{5}{8}$ by $\frac{3}{4}$

26. $\frac{5}{6}$ by $\frac{2}{3}$

27. $\frac{3}{4}$ by $\frac{5}{8}$

28. $\frac{8}{5}$ by $\frac{1}{4}$

29. $\frac{1}{2}$ by $\frac{3}{10}$

30. $2\frac{1}{3}$ by $\frac{1}{3}$

31. $4\frac{1}{4}$ by $\frac{1}{4}$

32. At \$$\frac{2}{5}$ each, how many caps can be bought for \$$2\frac{2}{5}$?

33. If a boy earns \$$\frac{3}{10}$ a day, how long will it take him to earn \$$2\frac{1}{2}$?

34. At \$$\frac{4}{5}$ a pound how many pounds of tea can I buy for \$$1\frac{3}{5}$?

Divide $5\frac{1}{2}$ by $\frac{3}{4}$.

A. $$5\tfrac{1}{2} \div \frac{3}{4} = \frac{11}{2} \div \frac{3}{4} =$$
$$\frac{22}{4} \div \frac{3}{4} = 22 \div 3 = 7\tfrac{1}{3}$$

A. Change both fractions to a common denominator and then divide the numerators.

B. $$5\tfrac{1}{2} \div \frac{3}{4} = \frac{11}{2} \div \frac{3}{4} =$$
$$\frac{11}{\cancel{2}} \times \frac{\overset{2}{\cancel{4}}}{3} = \frac{22}{3} = 7\tfrac{1}{3}$$

B. Since 1 divided by $\frac{3}{4}$ is $\frac{4}{3}$, $\frac{11}{2} \div \frac{3}{4}$ is $\frac{11}{2}$ of $\frac{4}{3}$, or $\frac{11}{2} \times \frac{4}{3}$.

Canceling and multiplying, the result is $7\frac{1}{3}$.

Since a fraction is an expression of division, $\frac{3}{8} \div \frac{5}{7}$ may be written $\dfrac{\frac{3}{8}}{\frac{5}{7}}$. When written in this form it is called a complex fraction.

A **complex fraction** is one having a fraction for one or both of its terms.

A complex fraction is **simplified** by performing the operations indicated.

Simplify :

1. $\dfrac{12\frac{1}{2}}{37\frac{1}{2}}$ 2. $\dfrac{2\frac{4}{5}}{1\frac{3}{4}}$ 3. $\dfrac{1\frac{1}{5}}{2\frac{1}{3}}$ 4. $\dfrac{33\frac{4}{9}}{7\frac{3}{4}}$

Simplify: $\dfrac{12\frac{1}{2} \times 11\frac{1}{5}}{68\frac{3}{4} + 1\frac{1}{4}}$

Solution: $12\frac{1}{2} \times 11\frac{1}{5} = \frac{25}{2} \times \frac{56}{5} = 140$
$68\frac{3}{4} + 1\frac{1}{4} = 70$
$\frac{140}{70} = 2.$

5. $\dfrac{\frac{3}{5} \times 6\frac{1}{4}}{\frac{2}{3} \times 7\frac{1}{2}}$ 6. $\dfrac{27\frac{2}{3} \times \frac{4}{9}}{12 \div \frac{2}{3}}$ 7. $\dfrac{\frac{2}{9}}{\frac{3}{4}} \times \dfrac{\frac{3}{4}}{\frac{5}{9}}$

8. If an express train moves at the rate of $40\frac{1}{4}$ miles an hour, how long will it take it to travel from A to B, a distance of $362\frac{1}{4}$ miles?

9. A cubic foot of ice weighs $57\frac{1}{2}$ pounds. How many cubic feet are there in a pile of ice that weighs $7515\frac{5}{8}$ pounds?

1. If 4 acres of land cost $300, what will 7 acres cost?

Statement:

$$\frac{\$300}{4} \times \frac{7}{1} = \$525.$$

If 4 acres cost $300, 1 acre will cost $\frac{1}{4}$ of $300, and 7 acres will cost 7 times $\frac{1}{4}$ of $300, or $525.

2. If $\frac{4}{5}$ of an acre of land cost $60, what will $\frac{7}{15}$ of an acre cost?

Statement:

$$\$60 \times \frac{5}{4} \times \frac{7}{15}.$$

If $\frac{4}{5}$ of an acre cost $60, 1 acre will cost $\frac{5}{4}$ of $60, and $\frac{7}{15}$ of an acre will cost $\frac{7}{15} \times \frac{5}{4} \times \$60$. Find answer by cancelation.

NOTE: — In this problem work, have the pupils make a statement of all processes to be used in the solution, and then shorten the work by cancelation. If this plan is followed, pupils must *think* before they begin to perform the necessary operations.

3. If $7\frac{1}{2}$ lb. of raisins cost $.85, what will $4\frac{1}{2}$ lb. cost?

4. If 9 oranges cost $\$.22\frac{1}{2}$, what will 16 oranges cost?

5. What will $4\frac{1}{3}$ tons of coal cost, if $10\frac{4}{7}$ tons cost $75.48?

6. How many gallons of molasses at $37\frac{1}{2}$¢ a gallon are worth as much as $12\frac{3}{4}$ bu. of potatoes at 40¢ a bushel?

7. If $6\frac{7}{8}$ cd. of wood cost $\$38\frac{1}{2}$, what will $2\frac{1}{2}$ cd. cost?

8. What must I pay for $37\frac{2}{3}$ tons of coal, if $12\frac{1}{3}$ tons cost $74?

9. If $13\frac{1}{3}$ lb. of sugar cost 80¢, what will $8\frac{3}{4}$ lb. cost?

10. A man who owns a mine sold $\frac{8}{40}$ of it for $3000. At the same rate, for what could he sell $\frac{1}{4}$ of the mine?

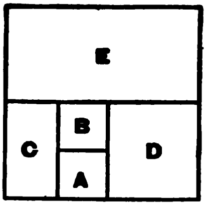
11. One box weighs $17\frac{1}{2}$ lb. A second box weighs 2 times as much as the first. A third box weighs $\frac{1}{5}$ as much as the second. Find the weight of the second box. Of the third box.

12. A man traveled $\frac{1}{4}$ of a certain distance by train, and $\frac{5}{8}$ by automobile. If he walked $\frac{1}{3}$ of the remaining distance, what part of the whole distance did he walk? If the whole distance was 180 miles, how many miles did he walk?

1. Add $20\frac{2}{3}$, $128\frac{3}{7}$, $4\frac{1}{21}$, $81\frac{5}{9}$.
2. Add $71\frac{1}{3}$, $96\frac{7}{8}$, $17\frac{7}{16}$, $9\frac{3}{4}$, $44\frac{23}{24}$.
3. Add $136\frac{3}{4}$, $7\frac{4}{7}$, $35\frac{5}{14}$, $71\frac{1}{2}$.
4. From $145\frac{2}{3}$ take $76\frac{1}{4}$.
5. Take $195\frac{5}{16}$ from $717\frac{3}{4}$.
6. Find the difference between $214\frac{3}{4}$ and $387\frac{3}{8}$.
7. Multiply $875\frac{3}{8}$ by 234.
8. Find the product of $645\frac{7}{8}$ and 412.
9. Multiply 215 by $41\frac{7}{8}$.
10. Multiply 575 by $69\frac{5}{6}$.
11. Find $\frac{2}{3}$ of $\frac{3}{4}$ of $\frac{5}{6}$ of $\frac{8}{9}$.
12. Change to a simple fraction $(\frac{5}{12} + \frac{3}{4}) \times (\frac{5}{14} - \frac{1}{7})$.
13. Multiply $136\frac{3}{4}$ by $41\frac{5}{8}$.
14. Find the product of $612\frac{1}{4}$ and $42\frac{5}{9}$.
15. Divide $6345\frac{3}{5}$ by 16.
16. What is the quotient of $583\frac{1}{3}$ divided by $43\frac{3}{4}$?
17. Simplify $\dfrac{18\frac{1}{2} \div 12\frac{1}{3}}{16\frac{1}{2} - 15\frac{5}{6}}$.
18. Simplify $\dfrac{\frac{1}{4} + 3\frac{1}{2}}{5\frac{2}{3} - 3\frac{1}{6}}$.
19. Simplify $\dfrac{\frac{7}{8}}{\frac{3}{4}} \times \dfrac{\frac{5}{9}}{\frac{1}{16}}$.
20. Divide $347\frac{5}{6}$ by 15. 692 by $19\frac{2}{9}$..
21. Divide $19\frac{4}{9}$ by $16\frac{2}{3}$. $786\frac{1}{2}$ by $30\frac{1}{4}$.
22. Add $2\frac{1}{15}$, $8\frac{1}{6}$, $27\frac{2}{3}$, $9\frac{1}{5}$.
23. Add $8\frac{3}{10}$, $37\frac{3}{4}$, $28\frac{4}{5}$, $9\frac{9}{20}$, $19\frac{1}{2}$.
24. From $27\frac{9}{40}$ take $18\frac{3}{5}$.
25. If $9\frac{1}{4}$ is taken from $12\frac{1}{6}$, what will remain?
26. Multiply $8\frac{3}{5}$ by 125. 15 by $16\frac{2}{3}$.
27. Divide $63\frac{1}{3}$ by $\frac{5}{6}$.
28. From $513\frac{7}{12}$ subtract $216\frac{1}{3}$.

TO FIND WHAT PART ONE NUMBER IS OF ANOTHER

Answer orally as many as possible.



1. E is what part of the whole square?

2. If the whole square is 4, what is the value of E?

3. 2 is what part of 4?

4. D is what part of the whole square?

5. If the whole square is called 8, what is the value of D?

6. 2 is what part of 8?

7. A is equal to what part of D? C is equal to what part of E?

8. *a.* 8 is what part of 64? *b.* $\frac{3}{5}$ is what part of $3\frac{3}{5}$?

a. $\frac{8}{64} = \frac{1}{8}$.

a. Since 1 is $\frac{1}{64}$ of 64, 8 is $\frac{8}{64}$ or $\frac{1}{8}$.

b. $\frac{\frac{3}{5}}{3\frac{3}{5}} = \frac{3}{\cancel{5}} \times \frac{\cancel{5}}{18} = \frac{1}{6}$

Learn: To find what part one number is of another, write the first number as the numerator of a fraction, the second number as its denominator, and reduce the fraction to its lowest terms.

9. What part of 150 is 120?

10. A peck is what part of a bushel?

11. A foot is what part of 144 inches?

12. There are 160 sq. rd. in an acre. What part of an acre is a rectangular piece of land 5 rd. long and 4 rd. wide?

13. There are 5280 ft. in a mile. An aeroplane rose 660 ft. into the air. What part of a mile was it from the ground?

14. An aeronaut drove his dirigible balloon at a height of 3000 ft. when crossing the Hudson River and at a height of 500 ft. when crossing New York City. What part of a mile was he from the ground at each height?

15. A man had $3150 on deposit in a bank. If he should withdraw $250, what part of his money would still remain in the bank?

16. What part of 144 is 72?

1. The area of an oblong is 24 sq. ft. What part of its area is that of a square whose side is 2 ft.?

2. Divide $2\frac{1}{3}$ by $2\frac{1}{4}$. Divide $4\frac{1}{2}$ by $2\frac{1}{4}$. Multiply together the two quotients.

3. A grain dealer had $2013.42. He bought 370 bu. wheat at $1.12; 980 bu. corn at 54¢; 536 bu. rye at 62¢; If he invested the rest of his money in flour at $6.25 a barrel, how many barrels of flour did he buy?

4. A can finish a piece of work in 4 days, B in 6 days, and C in 8 days. What part can each do in a day? What part can all do in a day? In how many days can the work be finished if all work together?

5. The sum of two numbers is 947. If one of them is 249, what is the other?

6. The smaller of two numbers is 278. If their difference is 179, what is the greater number?

7. If $5\frac{4}{7}$ yd. of cloth cost $1.17, how much must be paid for $43\frac{1}{3}$ yd.?

8. At $.75 a square yard it cost $99 to pave a walk. How many square yards are there in the walk? If the walk is 6 ft. wide, how long is it?

9. If a railroad charges $\frac{1}{2}$¢ a mile for the first 50 miles for carrying a barrel of flour, and then 4¢ for every 9 miles beyond the 50, what will it cost to carry 344 barrels 230 miles?

10. A man bought 27 head of cattle at $32 each. If $\frac{1}{3}$ of them were killed, and the remainder were sold at $53 each, find the gain or loss.

11. If a man owns $\frac{5}{9}$ of a farm and sells $\frac{2}{3}$ of his share for $3460, what is the whole farm worth?

12. If an automobile runs $12\frac{1}{2}$ miles while a train runs $34\frac{1}{4}$ miles, how much farther will the train run in $6\frac{3}{4}$ hours?

13. If it takes $1\frac{7}{8}$ bu. of seed to sow $2\frac{1}{4}$ acres, how many bushels are needed to sow $17\frac{1}{4}$ acres?

1. Write one tenth as a common fraction. Write it as a decimal fraction.

2. Read 100.001, 5.00405, 25.0025.

3. Read the following as, *a*, mixed decimals, *b*, as hundredths: 5.05, 26.01, 4.08.

4. How many decimal places are needed to write millionths?

5. Name the decimal places in order from tenths to hundred-millionths.

6. Annexing a cipher to a decimal has what effect upon the value of the decimal?

7. Prefixing a cipher to a decimal has what effect upon the value of the decimal?

8. How should decimals be arranged for convenience in adding and subtracting?

9. How do you multiply a decimal by 10? By 100?

10. How do you divide a decimal by 10? By 100? By 1000?

11. Moving a decimal point four places to the right would multiply the decimal by what?

Multiply the following by 10 *and by* 100:

12. 4.5 **13.** 16.04 **14.** 201.01 **15.** 7.206
16. 18.2 **17.** 41.08 **18.** 116.01 **19.** 3.110
20. 11.5 **21.** 10.26 **22.** 508.96 **23.** 8.594

Divide the following by 10 *and* 100:

24. 6.01 **25.** 26.31 **26.** 704.06 **27.** 2.017
28. 10.26 **29.** 40.08 **30.** 210.71 **31.** 4.004
32. 16.74 **33.** 11.21 **34.** 307.08 **35.** 1.001

36. $\frac{1}{10}$ of \$60 = —— .2 of \$60 = ——.

37. Five hundredths of a dollar are how many cents?

38. \$2.15 = 2 ——, 1 ——, 5 ——.

39. Read 1.75 as a mixed decimal and as hundredths.

40. .316 − .2 = ——. .316 − .01 = ——.

1. Add 1.206, 26.01, 106.1, .00405, 5.04.

2. Find the difference between twenty-one millionths and six thousandths.

3. Multiply one and five hundred-thousandths by 36.

4. Divide nineteen and eight thousandths by twenty-seven.

5. In multiplying or dividing decimals by integers, where do you place the decimal point?

6. Multiply 30.03 by .24.

$$\left.\begin{array}{r}30.03\\ \underline{.24}\end{array}\right\} = \begin{array}{r}.3003\\ \underline{24}\end{array}$$

First move the decimal point in the multiplicand as many places to the left as there are decimal places in the multiplier, then multiply as by integers.

Multiply:

7. .0463 by 3.5 **8.** 402.0056 by 7.08

9. 4.308 by .416 **10.** 8624.05 by .036.

11. Divide 32.85 by 4.5.

$$4.5\overline{)32.85} = 45\overline{)328.5}$$

$$\text{or } 4.5\overline{)32.8_{\wedge}5}$$

Before dividing change the divisor to an integer by moving the decimal points in both dividend and divisor to the right as many places as there are decimal figures in the divisor. Place the decimal point in the quotient directly above the point in the dividend.

Divide:

12. 57.3 by .004 **13.** 69.7 by .017

14. 2.516 by .156 **15.** 19.53 by 2.1

Specific gravity of any substance is found by dividing the weight of a cubic foot of that substance by 62.5 lb., the weight of a cubic foot of water.

The following gives the weight of a cubic foot of different substances. Find their specific gravity to the nearest thousandth:

16. Tin, 458.3 lb. **17.** Steel, 490 lb. **18.** Lead, 709.4 lb.

19. Gold, 1200.9 lb. **20.** Copper, 552 lb. **21.** Glass, 175.8 lb.

Do this work orally as far as possible.

1. Express the denominator of .5.

2. When .5 is written $\frac{5}{10}$, it is in the form of a common fraction.

3. How are decimal fractions changed to common fractions?

4. After expressing the denominator, what change should then be made in the fraction, as $\frac{5}{10} =$ ——.

Express as common fractions in their lowest terms:

5. .01
6. .0075
7. 17.15
8. 1.375
9. .0125
10. .005
11. 25.02
12. 5.875

13. You have learned that a fraction is an expression of division. After performing the division, to what form have you changed your common fraction?

Change the following to decimals, carrying the result to four decimal places when necessary:

14. $\frac{3}{8}$
15. $\frac{4}{9}$
16. $\frac{5}{11}$
17. $\frac{6}{9}$
18. $\frac{7}{8}$
19. $\frac{5}{6}$
20. $\frac{7}{12}$
21. $\frac{8}{15}$
22. $17\frac{2}{5}$
23. $49\frac{13}{20}$
24. $37\frac{25}{36}$
25. $21\frac{3}{4}$

Express the following common fractions as decimal fractions in hundredths:

26. $\frac{1}{2}$
27. $\frac{1}{4}$
28. $\frac{1}{3}$
29. $\frac{1}{5}$
30. $\frac{1}{6}$
31. $\frac{1}{8}$
32. $\frac{1}{10}$
33. $\frac{3}{4}$
34. $\frac{2}{3}$
35. $\frac{2}{5}$
36. $\frac{3}{5}$
37. $\frac{4}{5}$
38. $\frac{5}{6}$
39. $\frac{3}{8}$
40. $\frac{5}{8}$

41. Since *per cent* means *by hundredths*, express the common fractions above as per cents.

Express as per cents, that is, as hundredths:

42. $1\frac{3}{4}$
43. $2\frac{1}{2}$
44. $\frac{3}{20}$
45. $\frac{4}{25}$
46. $1\frac{7}{50}$
47. $\frac{14}{200}$
48. $\frac{15}{300}$
49. $\frac{20}{24}$
50. $\frac{19}{50}$
51. $\frac{7}{125}$

1. Add five and three hundred eighty-two ten-thousandths, one thousand two hundred thirty-five hundred-thousandths, eight hundred ninety-six and fifty-one thousand three hundred twenty-seven millionths.

2. Multiply .0915 by .0056 and write the product in words.

3. Divide .0002784 by .032.

4. Divide 1867.8 by 4000.

5. Find the cost of 825 bu. of grain at $\$1.66\frac{2}{3}$ a bushel.

6. Find the cost of 72 gal. of olive oil at $\$3.87\frac{1}{2}$ a gallon.

7. Add $17\frac{3}{8}$, $12\frac{1}{3}$, $.5\frac{4}{5}$, $12.48\frac{2}{3}$, $.4\frac{1}{3}$, $\frac{5}{8}$, $4\frac{2}{3}$, $16\frac{1}{8}$.

8. The product of two numbers is 13.02042, and one of the numbers is 6.414. What is the other number?

9. A cubic foot of brick weighs 118.3 lb. and a cubic foot of water weighs $62\frac{1}{2}$ lb. What is the specific gravity of brick, that is, the brick is how many times heavier than water?

10. Olive oil is .912 as heavy as water. Find the weight of a cubic foot of olive oil.

11. A bill board measures 20.5 ft. by 8.25 ft. Find the square feet of surface.

12. Suppose the wind is blowing against the bill board in example 11 with a pressure of 17.5 lb. to the square foot, find the total wind pressure against the board.

13. If the bill board was made strong enough to resist a pressure of 3000 lb., how many more pounds could it resist before falling?

14. Find to the nearest tenth the number of seconds it takes sunlight, traveling 186,650 mi. a second, to reach the earth. The sun is approximately 93,000,000 mi. from the earth.

15. A merchant bought 646 lb. of sugar for $38.76. In order to gain $9.69, for how much a pound must he sell it?

16. A man gave 180 acres to his son and had $\frac{2}{5}$ of his farm left. What is the value of the remainder at $\$39\frac{1}{2}$ an acre?

17. A can do a piece of work in 6 days, B in 8 days, and C in 12 days. In how many days can all do it together?

FINDING COST OF GOODS SOLD BY THE HUNDRED, THE THOUSAND, OR THE TON

1. Find the cost of 4625 fence posts at $9 per C.

$$\left.\begin{array}{r}\$9\\ \underline{46.25}\end{array}\right\} = \begin{array}{r}46.25\\ \underline{\$9}\\ \$416.25\end{array}$$

4625 = 46.25 C.

If 100 posts cost $9, 46.25 C posts will cost 46.25 times $9, or $416.25.

In this example it is easier to use 9 as the multiplier; in explaining the work, however, be careful to use $9 as the multiplicand.

2. Find the cost of 46,250 ft. of lumber at $28.40 per M.

$$\begin{array}{r}\$28.40\\ \underline{46.25}\end{array}$$

46,250 = 46.25 or 46¼ M.

If 1000 ft. cost $28.40, 46¼ M will cost 46¼ × $28.40.

3. Find the cost of 48,250 lb. of hay at $18 a ton.

A. $$\begin{array}{r}48.25\\ \underline{\$9}\end{array}$$

A. Since 2000 lb. cost $18, 1000 lb. will cost $9. If 1000 lb. cost $9, 48.25 M will cost 48.25 times $9.

B. $$\begin{array}{r}\$18\\ \underline{24\frac{1}{8}}\end{array}$$

B. 48,250 ÷ 2000 = $2\overline{)48.25}$ = 24.125 = 24⅛ T.

If 1 T costs $18, 24⅛ T will cost 24⅛ times $18.

4. Find the freight charges on a car-load of steel weighing 46,200 lb. at $2.25 per M.

5. On July 1, my gas meter registered 15,280 cu. ft., and on Oct. 1, 23,150 cu. ft. Find the cost of the gas consumed at 90¢ per M.

6. At $6.40 a ton, how much will 3675 lb. of coal cost?

7. What will 16,500 ft. of lumber cost at $22.75 per M?

8. Find the cost of 17,250 paving blocks at $8.65 per C.

9. Find the cost of 98,760 laths at $.35 per C.

10. What will 12,784 lb. of hay cost at $13.50 a ton?

11. Find the freight at 35¢ per C on 1500 lb. of hides, shipped from Chicago to Boston.

12. Find the total amount of freight paid on 4 car-loads of wheat, averaging 36,000 lb. each, shipped from Dakota to Minneapolis, the rate being 10¢ per C.

1. What does per cent mean?

2. Five per cent of anything is how many hundredths?

3. What is the sign of per cent?

4. Write 7 per cent, using the sign. Write it as a decimal.

5. What part of anything is 25% of it? 50% of it? $33\frac{1}{3}$%? 75%? $87\frac{1}{2}$%?

6. Find 25% of $16, $32, $100, $800, $4.88.

7. Find 3% of 12.

Solution: 1% of 12 is .12. Then 3% must be 3 × .12, or .36.

8. Find 2% of 12, 15, 80, 25, 400, 900.

9. If 50% of a number is 80, what is the number?

10. If 7% of a number is 28, what is the number?

Solution: If 7% of a number is 28, 1% is $\frac{1}{7}$ of 28, which is 4. If 4 is 1%, 100% is 100 times 4, or 400.

11. If 8% of a number is 24, what is the number?

12. If 3% of a number is 36, what is the number?

13. If 6% of a number is 54, what is the number?

14. *a.* What part of 8 is 4? *b.* What per cent is it?

Solution: Since 1 is $\frac{1}{8}$ of 8, 4 must be $4 \times \frac{1}{8}$, or $\frac{4}{8} = \frac{1}{2}$, Ans. *a.* $\frac{1}{2}$ of 100% = 50%, Ans. *b.*

15. What part and what per cent of 9 is 3? Of 20 is 5? Of 30 is 6? Of 140 is 70?

16. What is 2% of 1200? Of 600? Of 80 ?

17. 20 is what per cent of 40? Of 60? Of 50? Of 100?

18. What is $12\frac{1}{2}$% of 480? $16\frac{2}{3}$% of 240?

19. What per cent of 48 is 6? Of 144 is 12?

20. 100% of anything is what part of that thing?

21. $75 is what per cent of $100?

22. Give the dimensions of a rectangle whose breadth is 25% of its length.

23. Find 75% of $1200.

1. **Percentage** is the name of that part of arithmetic where all computing is done by hundredths.

2. Percentage is therefore an application of decimal fractions.

3. There are three problems in percentage:
   - *a*. To find a certain percentage of a number.
   - *b*. To find what per cent one number is of another.
   - *c*. To find a number when a percentage is given.

a. Find 6% of \$25.50.

$$\begin{array}{l} \$.255 = 1\% \text{ of } \$25.50 \\ \underline{6} \\ \$1.530 \end{array}$$

First find .01 by moving the point two places to the left, then multiply by the given per cent.

b. \$210 is what per cent of \$525?

$$\frac{\$210}{\$525} = \frac{2}{5} \qquad \text{or} \qquad \begin{array}{r} .40 \\ \$525\overline{)\$210.00} \\ \underline{2100} \end{array}$$

$$\tfrac{2}{5} \text{ of } 100\% = 40\%$$

Find what part one number is of the other, then change that fractional part to hundredths.

c. 346 is 40% of what number?

ANALYSIS.

$$\begin{array}{l} 40\% = 346 \\ 1\% = \tfrac{1}{40} \text{ of } 346 = 8.65 \\ 100\% = 100 \times 8.65 = 865 \end{array}$$

DECIMALLY.

$$\begin{array}{r} .40)346 = \\ 865 \\ 40\overline{)34600} \end{array}$$

Divide the given number by the rate per cent expressed decimally.

4. What is 17% of \$872?

5. From a cut of cloth containing 81 yd., 27 yd. were sold. What per cent were sold? What per cent remained?

6. 534 is 75% of what number?

7. \$750 is 62½% of my money. Find 75% of my money.

8. How much butter fat is there in 450 lb. of milk, if the creamery test shows that 36% of the total weight is fat?

9. An automobile was listed at \$2500, but was sold at 15% below the listed price. At what price was it sold?

1. Find the gain per cent when the cost is \$600 and the selling price is \$618.

$$\begin{array}{l} \$618 \\ \underline{\;\;600} \\ \;\;\$18 \text{ gain} \end{array} \qquad \begin{array}{r} .03 \\ \$600\overline{)\$18.00} \end{array}$$

First find the gain. Then find what per cent the gain is of the cost. The cost is always considered 100%. See *b*, Lesson 146.

2. The selling price is \$175. Find the gain per cent, if the cost is \$150.

3. Find the cost when the selling price is \$73.84 and the loss is 80%.

$$\begin{array}{l} 100\% \text{ cost} \\ \underline{\;\;80\% \text{ lost}} \\ \;\;20\% \text{ selling price} \end{array} \qquad \begin{array}{rcl} 20\% & = & \frac{1}{5} \\ \frac{1}{5} & = & \$73.84 \\ \frac{5}{5} & = & \$369.20 \end{array}$$

First find the selling per cent by subtracting the loss per cent from 100%. The example is then, \$73.84 is 20% of what number?

4. A man sold a horse for \$90 and lost 16$\frac{2}{3}$%. What did the horse cost?

5. A lot of goods were sold for \$540, at a loss of 40%. Find the cost.

6. A man sold a horse for \$90 and gained 25%. What did the horse cost?

$$\begin{array}{l} 100\% \text{ cost} \\ \underline{\;\;25\% \text{ gain}} \\ 125\% \text{ selling price} \end{array} \qquad \begin{array}{l} 125\% = \$90 \\ a.\ 1.25\overline{)\$90} \\ \quad \text{or} \\ b.\ \frac{5}{4} = \$90 \end{array}$$

First find the selling per cent by adding the gain per cent to 100%.

7. What per cent is gained when goods are bought for \$1236 and sold for \$1421.40?

8. What per cent is lost when goods are bought for \$144 and sold for \$128?

9. \$174.04 is 95% of how many dollars?

10. From a cask of rice containing 760 lb., 90 lb. were sold at one time, 60 lb. at another, and 40 lb. at another. What per cent was sold?

All business firms have paper ruled in the form of a bill, called *bill heads*. Write the following on bill heads or on paper that you rule in correct form:

1. John Farmer bought of George Grocer, July 26, 10 lb. coffee at 31½¢; 18 lb. starch at $.04; 1 box soap, $3.75; 48 lb. sugar at 6¢; 9 lb. tea at 65¢; 1 bbl. flour, $6.50.

2. Make out a bill for 6 pairs of men's shoes at $3.75; 2 pairs of boy's shoes at $1.50; 6 pairs of slippers at $.80; 4 pairs of rubbers at $.65.

3. Jos. Burke bought of Benjamin Robb & Co., Jan. 21, 18 lb. tea at $.85; 24 lb. coffee at 32½¢. Feb. 5, 15 lb. rice at 8¢; 2 boxes raisins at $1.20. Feb. 10, he paid $22. Make out his bill March 1.

4. The following is the receipt that was given to Jos. Burke, Feb. 10.

$22 ________ ________ Feb. 10, ____

Received of Jos. Burke, twenty-two dollars to apply on his account.

BENJAMIN ROBB & CO.

5. When the full amount of a bill is paid, the same form of receipt is given, except that "in full of account to date" is written in place of "to apply on his account."

6. Write a receipt in full for Mr. Burke, dated March 10.

7. Sept. 1, John D. King bought of H. C. Hamilton, 900 ft. flooring, at $23.50 per M; 750 ft. studding, at $18 per M; 2000 shingles, at $4.25 per M.

8. May 15, John Gilman bought of R. H. White, 20 yd. silk, at $1; 64 yd. sheeting, at 7¢; 25 doz. hose, at $1.20. May 25, $25 was paid on account. June 1, the account was paid in full. Write the receipt on account May 25. Write the receipt in full June 1. Make out the bill.

For ruling of paper for cash account see Lesson 80.

1. In all accounts there are two sides called "Cash Received," and "Cash Paid." Finding the difference between the two amounts is called "**Balancing the account.**"

Make out and balance the following:

2. June 1, George had on hand $2.75. Every day in the week he earned 20¢ from his paper route, and each week he earned 35¢ mowing a lawn. He spent 10¢ every day for carfare. June 15 he bought a cap for 50¢, and shoes for $2.50. Balance George's account on June 30.

3. Sept. 1, Mr. R. had on hand $10, and paid for meat 20¢, coffee, 35¢, peaches, 20¢. Sept. 2, he paid for laundry 32¢. for bread 10¢, for potatoes 18¢. Sept. 3, he received $7.50 and paid for cheese 15¢, for tomatoes 15¢, for milk 42¢.

4. A grocer's receipts and expenditures for the several days of a week were respectively as follows: Monday, $36.25 and $19.17; Tuesday, $42.18 and $10.81; Wednesday, $10.60 and $15.14; Thursday, $65.20 and $5.13; Friday, $34.11 and $14.08; Saturday, $90.15 and $45.15.

5. The following is a weekly account of the hours of labor such as is usually kept in all manufacturing establishments:

Name	M.	T.	W.	T.	F.	S.	Hours	Wages per day	Money due
Adams . .	8	7½	8½	8	9	8		$1.75	
Brown . .	7	8½	6	9	7	8½		$2.25	
Cowles . .	8	0	6	6	8	9		$1.50	
Dwight .	7	4	0	8	7½	8½		$2.75	
Total									

Counting 8 hr. to a day, enter the hours of labor and money earned in the proper columns. Find total paid out by firm.

1. Find the area of a rectangle 8½ ft. long and 6 ft. wide. What is the unit of measurement in this example?

$$\begin{array}{l} 8\tfrac{1}{2} = \text{sq. ft. in 1 row} \\ \underline{6} \\ 51 \text{ sq. ft.} \end{array}$$

Multiply the number of square feet in one row by the number of rows.

2. How many cubic inches are there in a box 6 in. long, 4 in. wide, and 2 in. deep? What is the unit of measurement in this example?

$$\begin{array}{l} 6 = \text{cu. in. in 1 row.} \\ \underline{4} \\ 24 = \text{cu. in. in 1 layer.} \\ \underline{2} \\ 48 = \text{cu. in. in box.} \end{array}$$

Multiply the number of cubic inches in one row by the number of rows to find the number of cubic inches in one layer. Then multiply the number of cubic inches in one layer by the number of layers.

3. A rectangle contains 72 sq. in. If it is 9 in. long, how wide is it?

72 sq. in. ÷ 9 sq. in. = 8
Hence 8 in. wide.

Divide the number of square inches in the rectangle by the number of square inches in one row to find the number of rows.

4. A garden is 10 rd. square. How many rods of fence will enclose it and divide it into 4 equal squares?

5. A rectangle 40 in. long contains 480 sq. in. How wide is it?

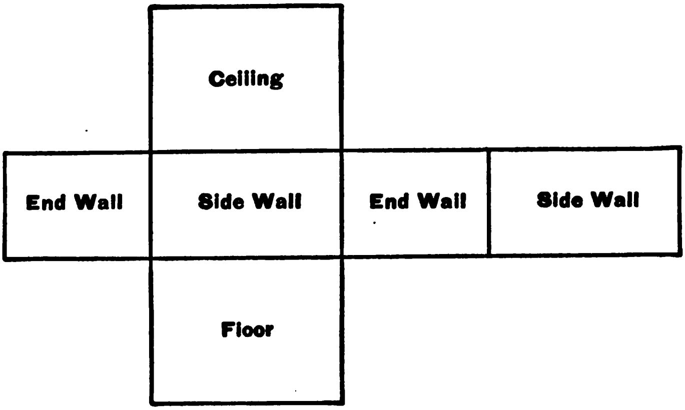
6. If you cut off a strip 1 in. wide all round a square foot of paper, how many square inches will you cut off?

7. At $2 a rod what will it cost to build a fence around a rectangle 20 rd. by 10 rd.?

8. How many 4-in. squares can you cut from a rectangle 12 in. by 8 in.?

9. How many cubic inches are there in a block of wood 3 ft. long and 10 in. square at the ends?

10. What two forms can you make, using 4 rectangles 1 ft. long and 3 in. wide?



1. This diagram represents the walls, ceiling, and floor of a room 16 ft. long, 12 ft. wide, and 9 ft. high. Scale $\frac{1}{16}$ in. to a foot. The walls form one rectangle. Find its dimensions. Its area. Give the dimensions of the ceiling. Its area.

NOTE: — Have the class in manual training make a model of a room so hinged that it will open like the diagram.

2. Find the number of square feet in the walls and ceiling of a room 14 ft. long, 12 ft. wide, and 8 ft. high.

2 × (14 ft. + 12 ft.) = 52 ft. perimeter.
52 sq. ft. × 8 = 416 sq. ft. in walls.
14 sq. ft.. × 12 = 168 sq. ft. in ceiling.
416 sq. ft. + 168 sq. ft. = 584 sq. ft.

Make a drawing to represent this room. Think of it as two rectangles. Give the length and width of each.

3. The perimeter of a room is 56 ft. 8 in. and its height 8 ft. 9 in. Find the area of the four walls.

4. A rectangular block of marble is 7 ft. long, 4 ft. wide, and $3\frac{1}{2}$ ft. high. Find the number of square feet in the surface of this block. Find the cost of the block at 60¢ a cubic foot.

5. A rectangular cistern is 8 ft. long, 6 ft. 6 in. wide, and $4\frac{1}{4}$ ft. deep. Find the number of square feet in the sides and bottom. Find the cost of lining it with sheet lead, weighing 9 lb. to a square foot, at 5¢ a pound.

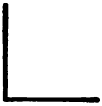


Fig. 1

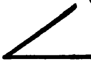


Fig. 2

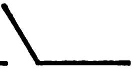


Fig. 3

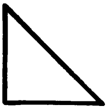


Fig. 4

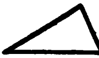


Fig. 5

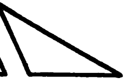


Fig 6

The clock dial used in Grade II for teaching time should be in the room at this time.

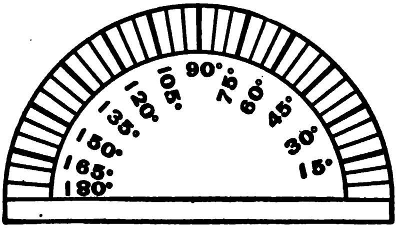
1. Take the clock dial. Place both hands at XII. Move the minute hand round to XII again. For convenience in measuring we say the whole circle is measured by **360 degrees,** or **360°**.

2. Move the minute hand to III. Over what part of the dial have you moved the hand? $\frac{1}{4}$ of 360° = 90°. We say the hands form an angle of 90° or a **right angle** (Fig. 1).

3. When two straight lines meet they are said to form an **angle**.

4. An angle that is less than a right angle is called an **acute angle** (Fig. 2). Move the hands on the clock dial to represent an acute angle.

5. An angle that is greater than a right angle is called an **obtuse angle** (Fig. 3). Change the hands on the clock dial to represent an obtuse angle.

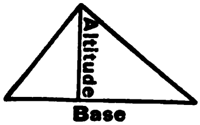


6. Cut from cardboard a figure like this and mark it in the same way. . This is a **protractor** sufficiently accurate for all practical purposes.

7. Using the protractor, measure the angles in Fig. 4, Fig. 5, Fig. 6.

8. In the wheel of my carriage there are 12 spokes. How many degrees are there between 2 spokes?

9. When the hour hand of the clock is at 12, where must the minute hand be that the two hands may be 30° apart?



1. A plane figure bounded by three straight lines is a **triangle**.

2. The **base** is the side upon which it rests. The **altitude** is its height measured on a line that is perpendicular to the base. One line is *perpendicular* to another when they form an angle of 90°.

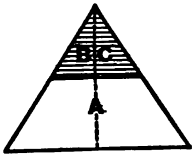


Fig. 1

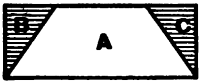


Fig. 2

3. Compare the base of Fig. 1 with that of Fig. 2. Compare their altitudes. How do you find the area of Fig. 2? Can you see from the drawings that both figures have the same area?

4. A triangle can be changed to a rectangle having the same base and ½ the altitude, or having the same altitude and ½ the base.

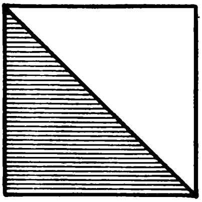


Fig. 3

5. From Fig. 3 we see that the area of a triangle is equal to ½ that of a rectangle having the same dimensions.

6. The area of a triangle equals:

a. The product of the base and ½ the altitude.

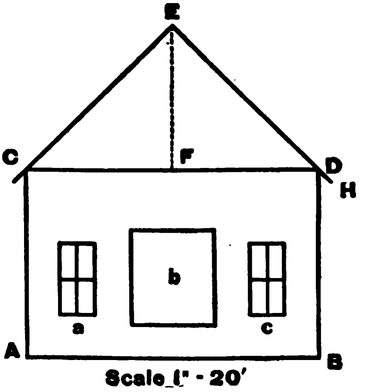
b. The product of the altitude and ½ the base.

c. One half the product of the base and altitude.

Note: — The above rules are generally given because of their brevity. Lead the pupils to see that when both dimensions are given in inches we cannot multiply *inches* by *inches* and have *square inches* as the product. We really multiply the *number of square inches* in one row by the *number* of rows.

Find the area of triangles having the following dimensions:

	Base.	Altitude.		Base.	Altitude.
7.	12 in.	10 in.	**8**.	20 in.	8 in.
9.	15 ft.	16 ft.	**10**.	17 ft.	9 ft.
11.	40½ rd.	10 rd.	**12**.	25½ yd.	12¼ yd.

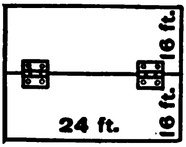


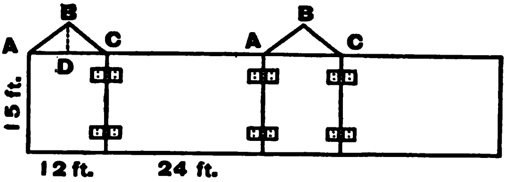
1. This drawing represents the end of a house. AB represents the width; AC the height to the eaves; EH the length of the rafters; the triangle CED is the *gable;* EF is the altitude of the gable; *a* and *c* are windows; *b* is a door. Using the scale, find each dimension.

2. To find the area of this end of the house you must find the area of one ——, and one ——.

3. Find the area without deducting doors and windows.

4. This drawing represents the roof and walls of a house. It was drawn from the model of a house made by a boy in the manual training room. To find the entire area, you find the area of —— rectangles and —— triangles.



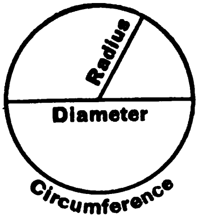


5. If BD is 3 ft., find the area of the 2 gables.

6. State the dimensions of the rectangle representing the roof. Find its area.

7. State the dimensions of the rectangle representing the 4 walls. Find the area of the 4 walls.

8. Make a drawing to represent the ends, sides, and roof of a house 42 ft. long, 36 ft. wide, and 18 ft. high from ground to eaves. The altitude of the gable is 12 ft. and the rafter is 22 ft. long. Find the number of square feet of lumber needed to board and roof the house.



1. This figure shows the circumference, diameter, and radius of a circle.

2. The line that bounds the circle is the **circumference**.

3. The line that passes through the center, cutting the circumference, is the **diameter**.

4. The distance from the center to the circumference is the **radius**. The radius is —— of the diameter.

5. Carefully measure the circumference and the diameter of a circle. The circumference is how many times the diameter?

6. Carefully compare the circumference and the diameter of several circles. Do you obtain the same result in each case?

7. It should be nearly $3\frac{1}{7}$. It is more nearly correct to say it is 3.1416. This ratio is usually expressed by the Greek letter π (pi).

8. *Learn:* *a.* *π times diameter equals circumference.*
b. *2 π times radius equals circumference.*
c. *Circumference divided by π equals diameter.*
d. *Diameter divided by 2 equals radius.*

Using $\pi = 3\frac{1}{7}$, find the circumference of a circle whose diameter is:

9. 105 ft. **10**. 126 in. **11**. 98 yd. **12**. 63 rd.
13. 112 ft. **14**. 119 yd. **15**. 84 in. **16**. 56 in.

When $\pi = 3\frac{1}{7}$, find the diameter of a circle whose circumference is:

17. 22 ft. **18**. 66 ft. **19**. 88 in. **20**. 264 in.
21. 132 in. **22**. 154 ft. **23**. 110 ft. **24**. 242 yd.

Using $\pi = 3.1416$, find the circumference or diameter of:

25. A wheel whose diameter is 24.017 in.
26. A bottle whose diameter is 1.56 in.
27. A globe whose circumference is 45.075 in.

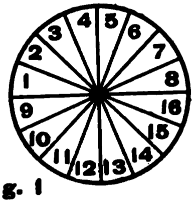


Fig. 1

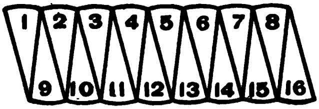


Fig. 2

1. Cut out of stiff paper a circle whose diameter is about 6 in. Cut it into 16 equal parts as is shown in Fig. 1.

2. Arrange the parts as shown in Fig. 2. Is the area of Fig. 2 the same as that of Fig. 1?

3. Into what shape, approximately, have you changed the circle?

4. The length of the rectangle (Fig. 2) is equal to what part of the circumference of the circle (Fig. 1)?

5. The width of the rectangle is the —— of the circle.

6. How do you find the area of the rectangle (Fig. 2)?

7. If Figs. 1 and 2 have the same area, have you found the area of the circle?

Learn: The area of a circle equals the product of ½ the circumference multiplied by the radius.

8. What two dimensions of the circle do you need to know in order to find the area?

9. When one dimension is given can you find the other? How?

Find the area of a circle whose:

10. Diameter is 14 ft.
11. Circumference is 22 ft.
12. Radius is 14 ft.
13. Diameter is 21 ft.
14. Circumference is 66 ft.
15. Radius is 4.2 ft.

16. The wind is blowing directly against a circular window whose diameter is 6.3 ft. with a pressure of 18.5 lb. to the square foot. What total wind pressure must the window resist?

1. All kinds of lumber are measured by board feet.

2. A **board foot** is equivalent to a square piece of board 1 ft. long, 1 ft. wide, and 1 in. thick.

3. Boards less than 1 in. in thickness are reckoned as one inch thick, and when no thickness is mentioned one inch is understood.

4. In giving dimensions of lumber, ′ is usually used to designate feet and ″ to designate inches. Thus the dimensions of a board 12 ft. long, 10 in. wide, and 1 in. thick would be written 12′ × 10″ × 1″.

5. How many feet of lumber are there in 24 boards, each 12′ × 10″ × 1″?

$24 \times 12 \times \frac{5}{6} = 240$ feet.
Use cancelation.

When boards are 1 in. thick the number of board feet corresponds with the square feet of surface. Hence the rule, multiply the number of feet in length by the number of feet in width to find the board feet in one board.

6. How many feet of lumber are there in 10 planks, each 9′ × 8″ × 2″?

$10 \times 9 \times \frac{2}{3} \times 2 =$ ——.

Since a plank 2 in. thick could be cut into 2 boards each 1 in. thick, we multiply the number of feet in one board by the number of inches in thickness.

ORAL EXERCISES

Find the number of feet in boards of the following dimensions:

7. 16′ × 12″
8. 16′ × 9″
9. 14′ × 6″ × 2″
10. 12′ × 6″
11. 12′ × 8″
12. 16′ × 6″ × 3″
13. 20′ × 9″
14. 12′ × 3″
15. 8′ × 3″ × 3″
16. 14′ × 18″
17. 15′ × 8″
18. 14′ × 12″ × 2″
19. 16′ × 9″
20. 18′ × 18″
21. 10′ × 9″ × 2″
22. 12′ × 4″
23. 20′ × 6″
24. 24′ × 8″ × 2″

25. A beam is 24 ft. long, 10 in. wide, and 8 in. thick. How many board feet are there in it?

According to their size and use pieces of lumber are called by various names, as boards, planks, scantlings, joists, plates, sills, girders, beams, posts, etc.

Copy the following and fill in the squares the number of board feet in a piece of lumber of the length and size indicated. The numbers at the top give the length in feet, the numbers at the left the thickness and width:

	Size	12	14	16	18	20	22	24	26
1	2×4								
2	2×8								
3	3×4								
4	3×6								
5	3×12								
6	4×8								
7	6×8								
8	8×12								
9	10×12								

10. At $16 per M find the cost of 42 boards, each 16′ × 6″.

11. At $28 per M find the cost of 750 planks, each 14′ × 12″ × 2″.

12. At $18 per M, what will be the cost of boards to build a fence 4 boards high round a field 160 yd. long, 120 yd. wide, if each board is 6 in. wide?

13. Find the number of feet of lumber required to floor a barn 36 ft. long, 17 ft. 6 in. wide, if the planks are 18 ft. long, 12 in. wide, and 2½ in. thick.

14. How many feet of boards will be needed to cover both gables of a building 27 ft. wide, if the height of the gable is 9 ft.?

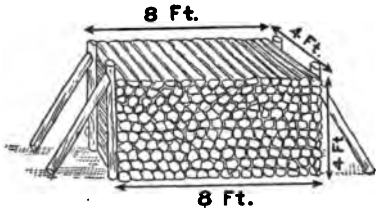

8 Ft.
4 Ft.
4 Ft.
8 Ft.

FIG. 1.

1. This picture shows a cord of wood.

2. Firewood is usually cut into sticks 4 ft. long. The length of the stick is the width of the pile. (See Fig. 1.)

3. A pile of wood 8 ft. long, 4 ft. wide, and 4 ft. high is called **a cord**. From the dimensions find how many *cubic feet* there are in a cord of wood.

128 cubic ft. = 1 cord (cd.)

4. How many cords are there in a pile of wood 16 ft. long, 4 ft. wide, and 8 ft. high.?

$\frac{16 \times 8 \times 4}{128}$ Divide the number of cubic feet in the pile by 128 cu. ft. to find the *number* of cords. Use cancelation.

5. How many cords are there in 2 piles of 4 ft. wood 12 ft. long, and 4 ft. high? What is it worth at $6.25 a cord?

6. How many cords are there in 640 cu. ft.?

7. How many cords of wood can be piled on a car 18 ft. long, 8 ft. wide, and 7 ft. high?

8. Find the cost of a pile of wood 60 ft. long, 4 ft. wide, and 8 ft. high, at $5.25 a cord?

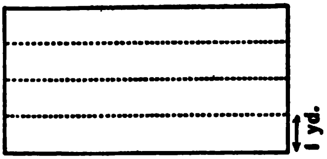
9. A pile of wood contains $6\frac{1}{2}$ cd. If this pile is 32 ft. long and $6\frac{1}{2}$ ft. high, how wide is it?

If $32 \times 6\frac{1}{2} \times x = 832$ cu. ft.,
then $832 \div (32 \times 6\frac{1}{2}) = x =$
$832 \times \frac{1}{32} \times \frac{2}{13} =$ ——.

Find the number of cubic feet in the given number of cords. Then find the missing dimension as indicated. Use cancelation to shorten the work.

10. At $4.75 a cord, a pile of wood cost me $28.50. How many cords were there? If the pile was 24 ft. long and 4 ft. wide, how high was it?

11. A pile of wood contains $4\frac{1}{2}$ cd. How long is it, if it is 7 ft. 6 in. high and 4 ft. wide?



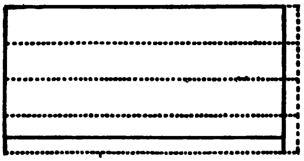
1. This diagram represents a room 24 ft. long and 12 ft. wide. If the carpet is 1 yd. wide, how many breadths running lengthwise will it take to cover the room? How long will each breadth be?

2. How do you find the number of breadths needed in a room when the breadths run lengthwise? When widthwise?

3. A room is 15 ft. wide and 20 ft. long. How many breadths of carpet, 1 yd. wide, will it take when they run lengthwise? How many yards will it take?

15 ft. ÷ 3 ft. = 5. No. of breadths.
20ft. = $6\frac{2}{3}$ yd. = Length.
$6\frac{2}{3}$ yd. × 5 = $33\frac{1}{3}$ yd.

Be careful that the width of the carpet and the dimensions of the room are of like denomination before dividing.


Scale $\frac{1}{16}$'-1'

4. This diagram represents a room 24 ft. long, $10\frac{1}{2}$ ft. wide. How many breadths of carpeting, 1 yd. wide, will be needed? How long will each breadth be if there is a loss of 1 ft. on each breadth for matching?

$10\frac{1}{2}$ ft. ÷ 3 ft. = $3\frac{1}{2}$ ∴ 4 breadths.
24 ft. + 1 ft. = 25 ft. = $8\frac{1}{3}$ yd. length.
$8\frac{1}{3}$ yd. × 4 = $33\frac{1}{3}$ yd.

Since breadths of carpet are not split, it will be necessary to buy 4 breadths. Since there is a loss of 1 ft. on each breadth, each breadth must be 24 ft. + 1 ft. = 25 ft. long.

Find the cost of carpeting when breadths run lengthwise:

	Room.	Width of carpet.	Loss in matching.	Price a yard.
5.	15 ft. × 12 ft.	1 yd.	6 in.	$ .85
6.	30 ft. × 20 ft.	$\frac{3}{4}$ yd.	none	$1.12\frac{1}{2}$
7.	21 ft. × 16 ft.	1 yd.	18 in.	.75
8.	24 ft. × 15 ft.	$\frac{3}{4}$ yd.	$\frac{1}{8}$ yd.	.65
9.	22 ft. × 18 ft.	27 in.	6 in.	.90

1. The quotient is 71, the divisor 42, and the remainder 15. What is the dividend?

2. Multiply 160 by .016 and divide the product by .0025.

3. Divide $2\frac{1}{2}$ by $3\frac{1}{3}$ and multiply the quotient by $3\frac{1}{5}$.

4. A grocer bought 14 bags of coffee for $142.24, but finding it damaged, he sold it at a loss of $30.10. How much did he receive a bag?

5. A man lost $$7\frac{1}{4}$ and found $$5\frac{3}{4}$ of it. If he then had $$24\frac{3}{5}$ how much had he at first?

6. A grocer sold $5\frac{3}{4}$ lb. of butter to one customer, $8\frac{7}{16}$ lb. to another, and $7\frac{7}{8}$ lb. to another. How many pounds of butter did he sell?

7. A farm of 50 acres is worth $3000. How much is $\frac{3}{4}$ of an acre worth?

8. A grocer bought 535 lb. of sugar at $5\frac{1}{5}$ ct. a pound, and sold it at a profit of 15%. What did he receive for it?

9. $3\frac{1}{8}$ cents is what per cent of $12\frac{1}{2}$ cents?

10. If 2.25 tons of hay cost $15.75, what will 5.75 tons cost?

11. If a vessel sails 325.5 miles in 46.5 hours, how many miles will she sail in $43\frac{3}{5}$ hours?

12. Find the cost of building a wall 110 ft. long, $2\frac{1}{2}$ ft. thick, and 10 ft. high, at 18¢ a cubic foot.

13. Find the cost of $416\frac{3}{8}$ cd. of wood at $$4.87\frac{1}{2}$ a cord.

14. The area of a rectangle is 285,516 square yards. Its length is 924 yd. Find its width.

15. Divide fifty and five thousandths by five millionths.

16. What number beside 149 will exactly divide 11,771?

17. How many boards 10 ft. long and 12 in. wide will it take to build a tight board fence, 5 ft. high, round a lot 60 ft. by 120 ft.? Boards are nailed on perpendicularly. Each 10 ft. board will make how many fence boards?

18. What is the area of a triangle that has a base line of 80 ft. and whose vertex is 35 ft. above the base line?

1. One inch is —— —— of a foot. One inch is —— % of a foot.

2. 13 inches are —— —— of a foot more than a foot.
13 inches are —— % more than a foot. 13 inches are —— % of a foot.

3. 11 inches are —— —— of a foot less than a foot.
11 inches are —— % less than a foot.

4. Ten inches are ——% of a foot. Ten inches are ——% less than a foot.

5. One foot is —— —— of a yard. One foot is —— % of a yard.

6. One foot is —— —— of a yard less than a yard.
One foot is —— % less than a yard.

7. 20% more than 25 means 25 + 20% of 25 = ——.

8. 25% less than 20 means 20 – 25% of 20 = ——.

9. Find a number that is 10% more than 50.

10. Find a number that is 33⅓% less than 24.

11. 16 is —— more than 12. 4 is —— —— of 12. Then 16 is ——% more than 12.

12. Ethel had 30¢ and Rebecca has 36¢. Ethel's money is —— —— of Rebecca's money. Ethel's money is —— % of Rebecca's money.

13. Rebecca has —— cents more than Ethel. Rebecca's money is —— % (of Ethel's money) more than Ethel's money. Rebecca's money is —— % of Ethel's money.

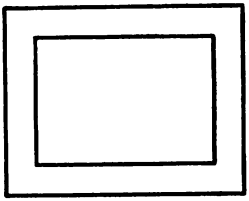
14. Ethel has —— cents less than Rebecca. Ethel has ——% (of Rebecca's money) less than Rebecca.

15. 33⅓% of 24 is ——. 24 is 33⅓% of ——. 24 is ——% of 72.

16. When ⅔ of a yard of cloth is worth 12¢., 1 yd. is worth —— cents. 1½ yd. are worth —— cents.

17. When 2½ tons of coal cost $15, 1 ton costs $——. ½ ton costs $——. 1½ tons cost $——.

1. A park 100 rd. long, 80 rd. wide, is surrounded by a walk 16½ ft. wide. How many square yards are there in the surface of the walk? If this walk is macadamized to a depth of 4 in., how many loads (1 cu. yd.) of material did it take?



Find the area of the entire park. Find the dimensions of the inner rectangle. Find the area of the inner rectangle. If you know the area of the outer and inner rectangles, how can you find the area of the walk? Be sure that all dimensions are of like denominations.

2. With a scale 1 in. to a foot, draw a figure to represent a square 4 ft. on a side. Inscribe within this a circle. (The circle must touch each of the 4 sides.) Find the area of the circle. Find the area of the part not included in the circle.

3. Find the number of square feet in the walls and ceiling of a room 28 ft. long, 20 ft. wide, and 12 ft. high. How much will it cost to plaster it at 33⅓ ct. a square yard?

4. A farmer sold 525 bu. of wheat and 20% less of oats. How many bushels of oats did he sell? The wheat was sold at $1.12 a bushel and the oats at 45 ct. a bushel. What did he receive for both?

5. A man bought 96 yd. of cloth at 40 ct. a yard and sold it at a gain of 20%. Find the selling price of each yard, and the amount received for all the cloth.

6. In one field there are 6 A. 80 sq. rd. If this is ⅓ the number of acres in another field, find the number of acres there are in both fields.

7. A farmer bought a 12-acre field of wheat for $225. The wheat yielded 28 bu. to an acre and was sold for $1.12½ a bushel. He paid $1.45 an acre for cutting, 5 ct. a bushel for thrashing, and $1.75 a load (42 bu.) for teaming.

a. Find the total number of bushels of wheat, and selling-price.

b. Find the amount paid for cutting.

c. Find the sum paid for thrashing, and for teaming.

d. Find the total gain or loss.

1. If Nellie has twice as many plums as Mary and both have 18 plums, how many has each?

Let x = number of Mary's plums.
$\underline{2x}$ = number of Nellie's plums.
$3x$ = 18 plums.
x = 6 plums.
$2x$ = 12 plums.

In examples like the above use the symbol x. This x stands in each example for any unknown quantity that we need to know to meet the conditions of the problem. In this problem x stands for the number of plums that Mary has. Why do we say $2x$ = number Nellie's plums? Where do we obtain $3x$ = 18 plums? If $3x$ = 18 plums, then x = ——— of 18 plums = —— plums.

2. Jennie has 3 times as many pins as Grace and together they have 24 pins. How many has each?

3. John has a certain number of marbles and his brother 3 times as many. If they both have 40 marbles, how many has John? How many has his brother?

4. Charles has 5 times as many apples as Henry. If Henry has 24 apples less than Charles, how many has each?

5. Divide 82 into three parts, so that the second may be twice the first and the third twice the second.

NOTE: — In this example we see that the third part is compared with the second part, and the second part with the first part. Therefore, we should let x stand for which part? It should stand for the number that we need to know most, because the other numbers are compared with it.

6. A number added to 3 times itself is 16. What is the number?

7. A number subtracted from 4 times itself is 27. What is the number?

8. Nellie and Grace have 45 cents. If Nellie has 8 times as many cents as Grace, how many cents has each?

9. A fish pole and line are 24 ft. long. If the line is 2 times the length of the pole, how long is the pole?

10. Charles caught 3 trout, together weighing 48 oz. If the second one weighed twice as much as the first, and the third three times as much as the first, how much did each weigh?

1. A man paid $960 for a carriage and span of horses, paying 3 times as much for the horses as for the carriage. How much did he pay for each?

2. A and B together had $150 and B had four times as much money as A. How many dollars had each?

3. A man bought a harness and robe for $45. The harness cost 4 times as much as the robe. What was the price of each?

4. Three men, A, B, and C, formed a company with a capital of $6000. C put in 2 times as much as A, and B 3 times as much as A. How many dollars did each put in?

5. 108 marbles were divided among three boys. John had a certain number, James had three times as many as John, and Joseph had 5 times as many as John. How many did each boy have?

6. Divide $81 among A, B, and C, so that B shall have 5 times as much as A, and C 3 times as much as A.

7. A horse and carriage are together worth $450. The horse is worth twice as much as the carriage. What is each worth?

8. A man has 3 houses, which are together worth $5400. The second is worth twice as much as the first, and the third is worth as much as the other two. Find the cost of each.

9. Divide $216 among A, B, and C, so that B may have 3 times as much as A, and C may have 5 times as much as A.

10. Divide the number 136 into 3 parts such that the second shall be 3 times the first, and the third as much as the first and second.

11. Two rectangles contain 96 sq. ft. If the area of the second rectangle is 2 times that of the first, find the area of the second rectangle.

12. What are the dimensions of a rectangular field whose length is twice its width, if the whole perimeter is 168 rd.?

13. A house and lot cost $13,600. The cost of the house was 16 times the cost of the lot. Find the cost of each.

1. I hired a horse of a livery man at the rate of $1 an hour. How much *horse hire* ought I to pay for the *use* of the horse for 5 hours?

2. I rent a house at the rate of $30 a month. How much *rent* ought I to pay for the *use* of the house for 6 months?

3. I borrowed $100 of Mr. B, at the rate of $6 for $100 for 1 year. How much *interest* ought I to pay for the *use* of Mr. B's money for one year?

4. **Interest** is money paid to the owner for the use of money.

5. Instead of saying " at the rate of $6 for $100 for one year," we usually say, " interest at 6%." The words " for one year" are understood.

6. What is 6% of $100? We see that "$6 for $100," or " interest at 6%," really mean the same thing.

7. I asked a man to lend me $200. He said he would, at 6%. What did he mean? How much interest ought I to pay him for a year?

8. The **principal** is the sum of money for which interest is paid.

9. In the 3d example, what was the principal? What was the interest?

10. If at the end of the year I paid Mr. B both principal and interest, what amount did I pay?

11. The **amount** is the sum of the principal and interest.

12. At 6% a year find the interest on $700 for 5 yr.

$$\begin{array}{r l} \$700 & \\ .06 & \\ \hline \$42.00 & \text{int. for 1 yr.} \\ 5 & \\ \hline \$210.00 & \text{int. for 5 yr.} \end{array}$$

Multiply the principal by the rate to find the interest for one year.

Multiply the interest for one year by the number of years.

13. What is the interest of $500 at 5% for 1 year?

14. At 6% what is the interest of $200 for 2 years?

15. What is 1 year's interest of $400 at 4%?

At 4% find the interest of:

1. $200 for 3 yr.
2. $300 for 2 yr.
3. $400 for 4 yr.
4. $500 for 7 yr.
5. $800 for 1 yr.
6. $600 for 2 yr.
7. $600 for 1½ yr.
8. $400 for 2½ yr.

At 6% find the interest of:

9. $500 for 6 yr.
10. $300 for 3 yr.
11. $800 for 2 yr.
12. $900 for 1 yr.
13. $600 for 1½ yr.
14. $400 for 2½ yr.
15. $500 for 1 yr. 6 mo.
16. $200 for 2 yr. 6 mo.

At 5% find the interest of:

17. $800 for 4 yr.
18. $500 for 3 yr.
19. $900 for 2 yr.
20. $400 for 6 yr.
21. $600 for 6 yr.
22. $700 for 2 yr.
23. $400 for 1 yr. 3 mo.
24. $200 for 4½ yr.
25. $800 for 2 yr. 3 mo.
26. $600 for 3½ yr.

At 6% what is the interest of:

27. $ 60 for 1 yr.? For 2 yr.? For 1 yr. 6 mo.?
28. $ 40 for 2 yr.? For 4 yr.? For 1½ yr.?
29. $1000 for 5 yr.? For 3 yr.? For 2½ yr.?
30. $ 500 for 1 yr.? For 6 mo.? For 4 mo. (⅓ yr.)?

31. What is the amount in examples 17 to 26?

32. What is the interest of $200 for 1 yr. at 4 %? What would it be for 2 yr. at 3%? For 3 yr. at 2%?

33. Mr. Scott borrowed of Mr. Brown $500 at 4%, promising to pay the interest every 6 months. How much interest did he pay each time? If he kept the money 2 yr. 6 mo., how much interest did he pay for the entire time?

Find the interest of:

1. $574 for 3 yr. at 6%   For 5 yr. at 4%.
2. $657 for 4 yr. at 7%.   For 6 yr. at 3%.
3. $730 for 5 yr. at 5%.   For 4 yr. at 4%.
4. $276 for 8 yr. at 3%.   For 5 yr. at 6%.
5. $406 for 3 yr. at 5%.   For 6 yr. at 4%.

6. When one man borrows money of another he usually gives him a written promise to repay the money. This written promise is called a **promissory note**.

A Promissory Note

$100 New Haven, May 12, 1909.
On demand I promise to pay to the order of
———— *George W. Bishop* ————
One Hundred———— *Dollars*
with interest at 6%.
Value received. Chas. Whittaker.

7. In this note who promises to pay? To whom does he promise to pay? How much does he promise to pay?

8. The one who promises to pay is called the **promisor** or **maker**. He is also the **borrower**.

9. The one to whom the promise is made is called the **promisee** or **payee**. He is also the **lender**.

10. The sum of money named in the note is called the **face**. It is also the **principal** on which interest is to be paid.

11. In this note, who is the maker?

12. Who is the lender?

13. What sum of money is the face?

14. If Mr. Whittaker keeps the money one year, how much interest must he pay?

15. What will be the amount of the principal and interest?

16. Write a promissory note, making yourself promisor and one of your schoolmates the promisee.

1. If I pay 6 cents for the use of $1 for 1 year, what part of the year can I keep the dollar and pay only one cent interest?

2. How many months is $\frac{1}{6}$ of the year? Then what is the interest of $1 for 2 mo.?

3. Since $.01 is the interest of $1 for 2 months, the interest of $8 will be 8 times $.01 or $.08. The interest of $100 will be 100 times $.01 or $1.00.

4. To find the interest on any sum of money for 2 mo. or 60 days, at 6%, we move the decimal point two places to the left. This is the same as multiplying $.01, the interest of $1 for 2 mo., by the sum of money.

5. This method of computing interest is known as the 60-*day method,* and sometimes as the *banker's method.*

There are many methods of computing interest, no one of which is best for all examples. Since it seems unwise to burden the pupil's memory with different methods, we shall confine ourselves to the 60-day method, and the one illustrated in Lesson 166, which may be used in all examples where the time is given in years and months only.

Find the interest on the following sums of money for 2 mo. at 6%.

6.	$60	**7.**	$ 88	**8.**	$305	**9.**	$543	**10.**	$5678
11.	30	**12.**	72	**13.**	475	**14.**	842	**15.**	4978
16.	48	**17.**	46	**18.**	267	**19.**	643	**20.**	9876
21.	39	**22.**	83	**23.**	394	**24.**	500	**25.**	4743
26.	62	**27.**	450	**28.**	412	**29.**	402	**30.**	3649
31.	79	**32.**	276	**33.**	516	**34.**	819	**35.**	6891
36.	12	**37.**	118	**38.**	618	**39.**	549	**40.**	4206
41.	24	**42.**	374	**43.**	728	**44.**	675	**45.**	2060
46.	31	**47.**	333	**48.**	175	**49.**	715	**50.**	1008
51.	43	**52.**	147	**53.**	379	**54.**	825	**55.**	7042
56.	54	**57.**	274	**58.**	741	**59.**	396	**60.**	3164

NOTE: — In all examples, unless otherwise stated, 6% is understood.

1. Find the interest of \$500 for 6 mo.

\$ 5.00 = int. for 2 mo.
\$15.00 = int. for 6 mo.

First find the interest for 2 mo. by pointing off 2 places. Since 6 mo. is 3 times 2 mo., multiply the interest for 2 mo. by 3.

NOTE: — In working examples by this method do not write the multipliers.

2. After finding the interest for 2 mo., how would you find the interest for 4 mo.? 10 mo.? 1 yr. (12 mo.)?
3. Find the interest on \$206 for 4 mo. 6 mo. 8 mo.
4. Find the interest on \$640 for 10 mo. For 1 yr.
5. Find the interest for 6 mo. on \$1800. On \$2400.
6. Find the interest for 1 yr. on \$750. On \$375.
7. Find the interest for 1 yr. on \$405. On \$145.
8. What is the interest on \$1216 for 8 mo.? Of \$2445?
9. What is the interest on \$800 for 9 mo.?

\$ 8.00 = int. for 2 mo.
\$32.00 = int. for 8 mo.
4.00 = int. for 1 mo.
\$36.00 = int. for 9 mo.

First find the interest for 8 mo. Then for the odd month, which must be ½ of the interest for 2 mo.

10. Find the interest on \$900 for 9 mo.
11. Find the interest on \$400 for 7 mo. (6 mo. + 1 mo.)
12. Find the interest on \$2200 for 1 yr. 3 mo.

\$ 22.00 = int. for 2 mo.
\$132.00 = int. for 1 yr.
22.00 = int. for 2 mo.
11.00 = int. for 1 mo.
\$165.00 = int. for 1 yr. 3 mo.

First find the interest for 1 year, then for 2 mo. and 1 mo.

13. What is the interest on \$3460 for 1 yr. 5 mo.?
14. What is the interest on \$489 for 1 yr. 7 mo.?

1. Find the interest on $1240 for 2 yr. 11 mo.

$ 12.40 = int. for 2 mo.
$ 74.40 = int. for 1 yr.
74.40 = int. for 1 yr.
62.00 = int. for 10 mo.
6.20 = int. for 1 mo.
$217.00 = int. for 2 yr. 11 mo.

The solution sufficiently explains the method for finding interest for any number of years.

2. Find the interest on $987.60 for 3 yr. 5 mo.

$ 9.876 = int. for 2 mo.
$ 59.256 = int. for 1 yr.
118.512 = int. for 2 yr.
19.752 = int. for 4 mo.
4.938 = int. for 1 mo.
$202.458 = int. for 3 yr. 5 mo. $202.46.

It is sufficiently accurate to retain only mills in the partial results, and express the final result to the nearest cent.

Find the interest on:

3. $265 for 2 yr. 7 mo.
4. $425 for 3 yr. 4 mo.
5. $1464 for 1 yr. 6 mo.
6. $5618 for 2 yr. 10 mo.

7. Find the interest on $560 for 75 days.

$5.60 = int. for 60 d.
1.40 = int. for 15 d.
$7.00 = int. for 75 d.

Point off two places to find the interest for 2 mo., or 60 days. To find the interest for 15 days, we find $\frac{1}{4}$ of the interest for 60 days. Why?

8. Find the interest on $480 for 25 days.

$4.80 = interest for 60 d.
$1.60 = int. for 20 d.
40 = int. for 5 d.
$2.00 = int. for 25 d.

25 days = 20 d. + 5 d.
Int. for 20 d. = $\frac{1}{3}$ int. for 60 d.
Int. for 5 d. = $\frac{1}{4}$ int. for 20 d.

9. Find the interest on $750 for 45 days.
10. Find the interest on $1240 for 80 days.
11. Find the interest on $246.50 for 75 days.

1. 6 days is what part of 60 days?

2. Since the interest of $1 for 60 days at 6% is $.01, the interest for 6 days will be $\frac{1}{10}$ of $.01, or $.001.

3. Since the interest on $1 for 6 days is $.001, the interest of $10 will be 10 times $.001 or $.01. The interest of $100 will be 100 times $.001 or $.10. The interest of $600 will be 600 times $.001 or $.60.

Learn: To find the interest for 6 days on any sum of money move the decimal point 3 places to the left.

4. By pointing off 3 places find the interest for 6 days on the sums of money given in Lesson 169.

5. Find the interest on $780 for 12 days.

$ .78 int. for 6 d.
$1.56 int. for 12 d.

By taking parts or multiples of the interest for 6 d., the interest for any number of days may be found.

6. Find the interest on $1240 for 18 days.

7. Find the interest on $520 for 15 days.

$5.20 int. for 60 days. or
$1.30 int. for 15 days.

$ .52 int. for 6 d.
$1.04 int. for 12 d.
.26 int. for 3 d.
$1.30 int. for 15 d.

8. Find the interest on $480 for 24 days.

9. Find the interest on $697 for 12 days.

10. Find the interest on $368 for 18 days.

11. Find the interest on $846 for 1 yr. 2 mo. 12 d.

$ 8.46 int. for 2 mo.
.846 int. for 6d.
$50.76 int. for 1 yr.
8.46 int. for 2 mo.
1.692 int. for 12 d.
$60.912 int. for 1 yr. 2 mo. 12 d.

Write the interest for 2 mo. and also for 6 days. Draw a line to separate them from the work below. Take such multiples or parts of these sums as will give the interest for the required time.

The following table will show the method of finding interest at 6% for any number of days.

1 day = $\frac{1}{6}$ of 6 days.
2 days = $\frac{1}{3}$ of 6 days.
3 days = $\frac{1}{2}$ of 6 days.
4 days = 3 d. + 1 d.
5 days = 3 d. + 2 d.
7 days = 6 d. + 1 d.
8 days = 6 d. + 2 d.
9 days = 6 d. + 3 d.
10 days = $\frac{1}{6}$ of 60 d.
11 days = 10 d. + 1 d.
13 days = 12 d. + 1 d.
14 days = 12 d. + 2 d.
15 days = 12 d. + 3 d. or $\frac{1}{4}$ of 60 d.

16 days = 15 d. + 1 d.
17 days = 15 d. + 2 d.
19 days = 18 d. + 1 d.
20 days = $\frac{1}{3}$ of 60 d.
21 days = 20 d. + 1 d.
22 days = 20 d. + 2 d.
23 days = 20 d. + 3 d.
25 days = 20 d. + 5 d. or 24 d. + 1 d.
26 days = 24 d. + 2 d.
27 days = 24 d. + 3 d.
28 days = 24 d. + 3 d. + 1 d.
29 days = 24 d. + 3 d. + 2 d.
31 days = 30 d. + 1 d.

1. Find the interest on \$475 for 1 yr. 1 mo. 5 d.

\$4.75 = int. for 60 d.
.475 = int. for 6 d.
\$28.50 = int. for 1 yr.
2.375 = int. for 1 mo.
.237 = int. for 3 d.
.158 = int. for 2 d.
\$31.270 = int. for 1 yr. 1 mo. 5 d.

Find the interest on:

2. \$1728 for 1 yr. 4 mo. 6 d.
3. 466.56 for 3 yr. 8 mo. 15 d.
4. 230.40 for 3 yr. 10 mo. 18 d.
5. 323.50 for 1 yr. 11 mo. 17 d.
6. 960 for 4 yr. 5 mo. 21 d.
7. 976.25 for 5 yr. 3 mo. 11 d.
8. 358.30 for 3 yr. 7 mo. 20 d.

Find the interest on the following:

1. $475 for 1 yr. 2 mo. 5 d. For 2 yr. 3 mo. 7 d.
2. $368 for 1 yr. 3 mo. 7 d. For 3 yr. 2 mo. 5 d.
3. $694 for 1 yr. 4 mo. 8 d. For 4 yr. 5 mo. 7 d.
4. $173.34 for 1 yr. 5 mo. 9 d. For 2 yr. 6 mo. 8 d.
5. $25.60 for 1 yr. 7 mo. 10 d. For 1 yr. 6 mo. 9 d.
6. $136.50 for 1 yr. 3 mo. 11 d. For 3 yr. 4 mo. 10 d.
7. $97.50 for 1 yr. 11 mo. 13 d. For 4 yr. 5 mo. 12 d.
8. $1264 for 1 yr. 9 mo. 14 d. For 3 yr. 3 mo. 13 d.
9. $1478 for 1 yr. 5 mo. 15 d. For 2 yr. 7 mo. 14 d.
10. $672 for 1 yr. 2 mo. 16 d. For 2 yr. 4 mo. 15 d.
11. $47.95 for 1 yr. 3 mo. 17 d. For 3 yr. 9 mo. 16 d.
12. $106.25 for 1 yr. 4 mo. 19 d. For 1 yr. 3 mo. 18 d.
13. $16.48 for 1 yr. 5 mo. 20 d. For 2 yr. 4 mo. 19 d.
14. $74.34 for 1 yr. 6 mo. 21 d. For 3 yr. 2 mo. 20 d.
15. $1497 for 1 yr. 7 mo. 22 d. For 2 yr. 4 mo. 21 d.
16. $748.25 for 1 yr. 8 mo. 23 d. For 4 yr. 8 mo. 22 d.
17. $1200 for 1 yr. 9 mo. 25 d. For 3 yr. 3 mo. 23 d.
18. $567 for 1 yr. 10 mo. 26 d. For 2 yr. 1 mo. 24 d.
19. $1463 for 1 yr. 11 mo. 27 d. For 3 yr. 6 mo. 25 d.
20. $1476.36 for 1 yr. 1 mo. 28 d. For 4 yr. 10 mo. 26 d.
21. $1472.40 for 1 yr. 2 mo. 29 d. For 3 yr. 1 mo. 27 d.
22. $1491.50 for 1 yr. 5 mo. 13 d. For 2 yr. 3 mo. 17 d.
23. $2468 for 1 yr. 2 mo. 26 d. For 1 yr. 1 mo. 1 d.
24. $680.50 for 1 yr. 3 mo. 27 d. For 1 yr. 5 mo. 16 d.
25. $746.30 for 1 yr. 1 mo. 11 d. For 2 yr. 2 mo. 13 d.
26. $123.40 for 1 yr. 7 mo. 19 d. For 5 yr. 3 mo. 15 d.
27. $567.80 for 1 yr. 3 mo. 21 d. For 3 yr. 7 mo. 19 d.
28. $912.30 for 1 yr. 4 mo. 17 d. For 4 yr. 2 mo. 21 d.
29. $987.60 for 1 yr. 2 mo. 15 d. For 2 yr. 3 mo. 24 d.
30. $876.50 for 1 yr. 6 mo. 16 d. For 3 yr. 4 mo. 25 d.

1. Find the interest on $1200 for 1 yr. 2 mo. 18 d. at 5%.

$12.00 = int. for 2 mo.
1.20 = int. for 6 d.
$72.00 = int. for 1 yr.
12.00 = int. for 2 mo.
3.60 = int. for 18 d.
$87.60 = int. at 6%.
14.60 = int. at 1%.
$73.00 = int at 5%.

Find the interest at 6% in the usual manner. If $87.60 is the interest at 6%, $\frac{1}{6}$ of $87.60, or $14.60, will be the interest at 1%. Then $73.00, the difference between the interest at 6% and the interest at 1%, will be the interest at 5%.

2. How would you find the interest at 7%?

3. How would you find the interest at 3%?

4. What per cent must you add to 6% to get 8%? 2% is what part of 6%?

5. If you subtract $\frac{1}{3}$ of 6% from 6%, what per cent will you have?

6. The following table will show the method of finding interest at any rate, after first finding the interest at 6%:

1% = $\frac{1}{6}$ of 6%.
2% = $\frac{1}{3}$ of 6%.
3% = $\frac{1}{2}$ of 6%.
4% = 6% − $\frac{1}{3}$ of 6%.
4$\frac{1}{2}$% = 6% − $\frac{1}{4}$ of 6%.
5% = 6% − $\frac{1}{6}$ of 6%.
7% = 6% + $\frac{1}{6}$ of 6%.
7$\frac{1}{2}$% = 6% + $\frac{1}{4}$ of 6%.
8% = 6% + $\frac{1}{3}$ of 6%.
9% = 6% + $\frac{1}{2}$ of 6%.

Find the interest on:

7. $486.50 for 1 yr. 2 mo. 24 d. at 5%. At 7%. At 9%.

8. $247.65 for 1 yr. 3 mo. 15 d. at 4%. At 7$\frac{1}{2}$%. At 8%.

9. $1,264.30 for 1 yr. 5 mo. 13 d. at 5%. At 4$\frac{1}{2}$%. At 7%.

10. $798.81 for 1 yr. 1 mo. 1 d. at 3%. At 4 %. At 7$\frac{1}{2}$%.

11. $346.84 for 2 yr. 11 mo. 18 d. at 5%. At 7%. At 8%.

12. $816.24 for 3 yr. 7 mo. 6 d. at 7%. At 4$\frac{1}{2}$%. At 5%.

13. $745.00 for 1 yr. 10 mo. 10 d. at 6%. At 7%. At 8%.

14. $225.75 for 1 yr. 4 mo. 11 d. at 4$\frac{1}{2}$%. At 7$\frac{1}{2}$%. At 7%.

15. $268.80 for 2 yr. 3 mo. 14 d. at 5%. At 4%. At 6%.

Find the interest at 6% on:

1. $100 for 1 yr.
2. $100 for 1 yr. 6 mo.
3. $100 for 1 yr. 6 mo. 6 d.
4. $200 for 8 mo. 12 d.
5. $200 for 10 mo. 18 d.
6. $200 for 1 yr. 5 mo.
7. $200 for 1 yr. 7 mo. 24 d.
8. $300 for 4 mo. 18 d.
9. $300 for 9 mo.
10. $300 for 3 mo. 18 d.
11. $400 for 6 mo. 12 d.
12. $400 for 1 yr. 3 mo. 18 d.
13. $500 for 7 mo.
14. $500 for 1 yr. 2 mo.
15. $600 for 10 mo. 24 d.
16. $600 for 48 d.

17. 125% = 1¼. Find 125% of 12, 20, 80, 120.

18. Find 66⅔% of 27, 36, 48, 300.

19. Express in common fractions in the lowest terms:
10%, 75%, 150%, 37½%, 116⅔%, 87½%, 133⅓%.

20. Find 50% of $72, $½, $12⅔, 4, 50%.

21. A man bought flour at $5 a barrel, and sold it at a gain of 20%. Find his gain on each barrel. If he gained $26 in all, how many barrels did he sell?

22. A merchant paid $5.75 for an article and sold it at a profit of 20%. How much did he gain? For how much did he sell it?

23. What part of 12 is 6? Of 16 is 4? Of 12 is 2?

24. Substitute per cent for part in example 23, and give answers.

25. What part and what per cent of 10 is 5? Of 100 is 25? Of 500 is 50? Of 20 is 20? Of 120 is 40? Of 75 is 25?

26. 40 is 20% of what number? 12 is 6% of what number?

27. A man invested $540 and lost $90. What per cent did he lose?

28. From a herd of 300 cattle, the farmers of a certain town bought 50. What per cent of the herd did they buy?

29. A man bought a horse for $200, and sold him so as to gain 10% of his cost. Find the gain and selling price.

In most business operations 30 days is considered a full month and the time between dates is found as in Lesson 192. For the purpose of finding interest the following method of subtracting dates is perferred as more accurate.

1. Find the interest on $396.16 from July 15, 1907, to Feb. 6, 1909.

From July 15, 1907, to July 15, 1908 = 1 yr.
From July 15, 1908, to Jan. 15. 1909 = 6 mo.
From Jan. 15, 1909, to Feb. 6, 1909 = 22 d.

From a study of this solution, you will notice that we first find the full years, then the full months, then the exact days remaining. In January after the 15th there are 16 days. 16 d. + 6 d. = 22 d. As soon as possible have the pupils do the work mentally, writing only the result.

2. Perform by this method examples 8 to 13 in Lesson 192, comparing results.

Find the interest at 6% on:

3. $649.21 from June 8, 1908, to Sept. 5, 1910.
4. $1,460.78 from June 6, 1908, to April 23, 1910.
5. $284.30 from Feb. 23, 1907, to April 5, 1909.
6. $366.44 from Jan. 5, 1907, to Jan. 27, 1909.
7. $491.73 from Nov. 16, 1908, to Nov. 28, 1910.
8. $91.36 from Aug. 12, 1907, to June 10, 1911.
9. $436.74 from March 25, 1907, to June 20, 1910.
10. $589.76 from May 11, 1907, to Jan. 7, 1911.
11. $125.40 from Sept. 25, 1908, to March 16, 1910.
12. $679.08 from Feb. 10, 1907, to Dec. 7, 1909.
13. $137.65 from Oct. 14, 1908, to Dec. 29, 1911.
14. $146.35 from June 7, 1908, to Feb. 11, 1911.
15. $154.25 from April 18, 1909, to Jan. 25, 1912.
16. $817.57 from Aug. 7, 1908, to Sept. 8, 1911.
17. $132.25 from Nov. 13, 1909, to May 2, 1911.

1. How long will it take a man to save $60, if he earns $15 a week, and spends $9 a week?

2. If $\frac{7}{8}$ of a yard of cloth costs 63 cents, what will $\frac{5}{8}$ of a yard cost?

3. A man sold a watch for $120, which was $\frac{4}{5}$ of what it cost him. How much did it cost?

4. If 4 men can do a piece of work in 12 days, how long will it take 8 men to do it? Compare 8 men with 4 men.

5. If 4 pipes will fill a cistern in 40 min., how many pipes will fill it in 10 min.? Compare 10 min. with 40 min.

6. An agent sold $300 worth of property, and charged 5% for so doing. How much did the agent receive?

7. Given the cost and loss per cent, what can be found?

8. A watch costing $80 was sold at a loss of 10%. For how much was it sold?

9. What number increased by 12 equals 16?

10. State example 9 in another way.

11. What number diminished by 5 equals 9?

12. State example 11 in another way.

13. A milliner bought a hat for $5 and sold it for $6. What per cent did she gain?

14. If 20 is $\frac{1}{4}$ more than another number, it is how many 4ths of that number? What is the number?

15. If a pound of cheese costs 12¢, what will $2\frac{2}{3}$ lb. cost?

16. A man's salary is $120 a month. If he spends $\frac{1}{3}$ of it for a watch, $\frac{1}{4}$ of it for a suit of clothes, and $\frac{1}{6}$ of it for board, how much of his salary remains?

17. If $\frac{1}{4}$ of a yard of cloth costs $2, what will $2\frac{1}{2}$ yd. cost?

18. Find the interest on $600 for 19 days at 6%.

19. $2\frac{1}{2}$ is $\frac{1}{4}$ of what number? $4\frac{1}{2}$ is 25% of what number?

20. What part of a pound is 12 oz.? 4 oz.?

21. Find the cost of 5 T., 400 lb., of coal, at $5 a ton.

22. At 80¢ a bushel what is a peck and a half of corn worth?

1. Multiply eighty-four thousandths by thirty-six ten thousandths.

2. Divide five thousand two hundred thirty-two millionths by sixteen thousandths.

3. If the divisor is 675, the quotient 488, and the remainder 548, what is the dividend?

4. Find the interest on $1763.25 for 1 yr. 3 mo. 14 d. at 6%.

5. If 24 men can do a piece of work in 9 days, in how many days can 18 men do it?

6. Find the interest on $128.12 for 1 yr. 3 mo. 22 d. at 8%.

7. If a car runs $48\frac{1}{2}$ miles an hour, how far will it run in 16 days, running $14\frac{1}{2}$ hours a day?

8. Find the cost of $19\frac{4}{5}$ cd. of wood at \$$6\frac{1}{4}$ a cord.

9. A number diminished by 20% of itself is what per cent of itself? What number diminished by 20% of itself equals 936?

10. A dealer sold 438 tons of coal at $4.75 a ton and a number of tons of another kind at $5.20 a ton. He received for all $4,254.10. How many tons did he sell?

11. If 18 tons of coal cost $117, how many tons can be bought for $234? Compare $234 with $117.

12. If $\frac{5}{9}$ of an acre of land can be bought for $35, what is the value of $49\frac{3}{7}$ acres?

13. Find the difference between one hundred million, one hundred thousand one hundred and ninety million, ninety thousand ninety.

14. Multiply one hundred eighty-three thousand, six hundred by four hundred twenty-seven thousand.

15. Divide twenty-seven million, one hundred eighty thousand by fifteen thousand one hundred.

16. If the product of two numbers is 143,186,076, and one of the numbers is 32,871, what is the other number?

17. Two boys together have 260 marbles. If one boy has 4 times as many as the other, how many has each?

18. What are the prime factors of 5075?

1. If 9 lb. of figs cost $1.08, what will 1 pound cost?

2. If 14 lb. of rice cost $1.12, what will 1 lb. cost?

3. I have a number in my mind. If I take 15 from it, 35 will remain. What is the number?

4. When is the selling price more than the cost?

5. When is the selling price less than the cost?

6. When is the selling price equal to the cost?

7. When the gain is 20%, what is the selling per cent?

8. When the loss is 10%, what is the selling per cent?

9. Make change from three quarters for a 69¢ purchase.

10. Make change from a half dollar for a 31¢ purchase.

11. A man, working for a farmer at 20¢ an hour, received as full pay 4 bu. potatoes at 50¢ a bushel. How many hours did the man work?

12. If a man can do a piece of work in 4 days, what part of it can he do in 2 days?

13. By selling land at $150 an acre I gained 25%. Find the cost.

14. A man paid $500 for wheat and sold the whole at a loss of 6%. Find the loss. Find the selling price.

15. If 1 barrel holds $2\frac{1}{2}$ bu., how many barrels will it take to hold 25 bushels?

16. Divide $5\frac{3}{5}$ by $\frac{2}{5}$. Divide $6\frac{3}{5}$ by $\frac{3}{5}$.

17. At the rate of $\$7\frac{1}{2}$ a ton, what will 12 tons cost?

18. What is the difference between $\frac{1}{3}$ of 2 and $\frac{2}{3}$ of 1?

19. If 4 yd. of cloth cost 72¢., what will $\frac{7}{9}$ of a yard cost?

20. How many cubic feet are there in a box 4 ft. long, 3 ft. wide, and 2 ft. high?

21. If 8 is $\frac{2}{3}$ of a number, what is the number? What is $\frac{3}{4}$ of it?

22. $\frac{1}{4}$ of 80 is how many times 5?

23. If $\frac{2}{3}$ of a man's age is 18 years, how old is he?

24. At 20¢ a yard what will 45 ft. of ribbon cost?

1. Some goods that cost $764 were sold at a loss of $17\frac{1}{2}\%$. Find the selling price.

2. Find the interest on $800 for 2 yr. 6 mo. 15 d. at 6%.

3. Find the interest on $750 for 3 yr. 3 mo. 3 d. at 5%.

4. If 35 yd. of cloth cost $12.25, how much will 42 yd. cost?

5. Find the cost of $15\frac{1}{4}$ cd. of wood at \$$6\frac{3}{8}$ a cord, and of $7\frac{3}{4}$ cd. at \$$5\frac{3}{8}$ a cord.

6. A house costs $6300, which is $1\frac{3}{4}$ times the cost of the lot. Find the cost of both house and lot.

7. Multiply the difference between 4.4 and .00027 by the product of 2.1 and .005.

8. Divide two-tenths by five ten-millionths.

9. Add $2\frac{1}{2}$, $3\frac{2}{7}$, $1\frac{11}{14}$, $7\frac{8}{14}$.

10. A can do a piece of work in 10 days, and B in 12 days. What part can each do in a day? What part can both do in a day? In what time can they do it by working together?

11. Multiply 630,000 by 3800.

12. Divide $816\frac{5}{12}$ by $16\frac{5}{6}$.

13. Multiply $13.703\frac{1}{3}$ by $.16\frac{5}{6}$.

14. Find the cost of $12\frac{1}{2}$ yd. of cloth at $34\frac{1}{8}$¢ a yard.

15. How many square feet are there in the floor of a room $17\frac{1}{2}$ ft. long and 16 ft. wide?

16. If $4\frac{1}{2}$ tons of coal cost $18, what will 18 tons cost?

17. A paid $10,500 for 125 acres of land. Find the cost of each acre. B bought 35 acres of land, paying $6 more an acre than A paid. How much did B pay for his land?

18. What number divided by 453 will give the quotient 307 and the remainder 109?

19. How many yards of carpet $\frac{3}{4}$ yd. wide will it take to cover a floor 18 ft. 6 in. by 15 ft. 3 in., if the breadths run lengthwise?

20. At 45¢ a cubic yard find the cost of digging a ditch 22 ft. 9 in. long, 8 ft. 6 in. wide, and 8 ft. deep.

1. What is $8\frac{1}{3}\%$ of 48 books?

2. What is the interest on $60 for 1 yr. 6 mo. at 5%?

3. Five boys bought a ball for 85¢ and sold it for 70¢. How much did each boy lose, if they divided the loss equally?

4. $20 is $16\frac{2}{3}\%$ of what sum?

5. A rose garden is 12 ft. long and 9 ft. wide. Into how many plots, each containing 3 square feet, can the garden be divided?

6. At 45¢ a pound, how many pounds can be bought for $1.35?

7. A merchant bought 5 boxes of butter for $50 and sold them so as to gain $10. What did he receive for each box?

8. Reduce: $\frac{17}{8}$, $\frac{24}{7}$, $\frac{37}{4}$, $\frac{25}{6}$, $\frac{15}{8}$, $\frac{35}{9}$.

9. Express decimally: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{7}{20}$, $\frac{1}{5}$, $\frac{4}{5}$, $\frac{16}{25}$.

10. At five cents a yard, how many yards of cloth can be bought for five dollars?

11. A grocer paid $60 for flour at $5 a barrel, and sold it at $5.75 a barrel. Find the entire gain.

12. At $1.25 a barrel what will a farmer receive for 72 barrels of apples?

13. Compare a 2-inch square with 2 square inches, in respect to both their areas and perimeters.

14. Find the cost of $6\frac{1}{2}$ lb. of chicken at 12¢ a pound.

15. Find the cost of 6 lb. of steak at $16\frac{2}{3}$¢ a pound.

16. Compare $2\frac{1}{3}$ with 14. Compare $2\frac{1}{2}$ with 20.

17. Take $\frac{3}{5}$ of a number from it, and 18 remains. What is the number?

18. 20 is what per cent of 40? $30 is what per cent of $120?

19. Divide the following by 10: 17.2, 2.4, .26, 209.2.

20. How many half-inch cubes will it take to make a pile 2 in. on every side?

21. How many quater-inch squares can you place on a piece of paper 6 in. by 5 in.?

1. Goods that cost $3072 were sold for $2560.

2. A farmer sold 860 bu. of wheat at $1.08 a bushel, and 20% less of oats at 52¢ a bushel.

3. A dealer sold 438 tons of coal at $4.75 a ton, and a number of tons of another kind at $5.20 a ton. He received for all $4,254.10.

4. 2, 2, 5, and 7 are four of the five factors of 1680.

5. A owns $\frac{5}{9}$ of a ship and sells $\frac{3}{5}$ of his share for $3600.

6. Two men had each $420. One of them spent 15% and the other $18\frac{1}{2}\%$ of this sum.

7. A train leaves New Haven at 8.45 A.M. and goes $27\frac{1}{3}$ miles an hour. Another train follows at 9 A.M. and goes 41 miles an hour.

8. An article cost $90. It was sold at a gain of $12\frac{1}{2}\%$.

9. A rectangular tank of water is 25 ft. long, 18 ft. wide, and 16 ft. 9 in. deep.

10. A merchant sold a lot of goods for $129 at a loss of $33\frac{1}{3}\%$.

11. The same merchant sold another lot for $73.85 at a gain of $16\frac{2}{3}\%$.

12. A owns 15% of a business; B, 25%; C, 28%, and D, the remainder. D's share is worth $17,232.

13. A merchant sold 12 bbl. of pork, averaging 200 lb. a barrel, at 12¢ a pound, and took in payment 160 hams, weighing 10 lb. each.

14. $\frac{3}{8}$ of a farm is in grass land, $\frac{5}{16}$ in corn, and $\frac{1}{4}$ in wheat. The rest of the farm, which is 16 acres, is in oats.

15. I own $\frac{2}{3}$ of a farm; $\frac{3}{4}$ of my share is worth $420.

16. The length of an oblong is 26 ft. and the width is 14 ft.

17. A man owned 156 acres of land, and sold 75% of it for $5265.

18. The circumference of a circular garden is 180 rd.

19. A and B together have 2538 acres of land. B has five times as much as A.

1. A **denominate number** is a concrete number denoting measure or weight, as 4 pounds, 6 quarts, etc.

2. A **unit of measure** is a definite unit, established by law or custom, used in measuring quantity.. Thus 1 bushel, 1 foot, are units of measure, and 1 pound is a unit of weight.

3. A **simple denominate number** is a denominate number expressed in terms of a single unit of measure, as 7 yd., 12 oz., 3 qt., etc.

4. A **compound denominate number** is a denominate number expressing more than one denominate unit related to each other, as 5 ft. 6 in.; 4 gal. 2 qt. 1 pt.

5. **Compound numbers** is the term usually given to compound denominate numbers.

6. **Reduction** is the changing from one form to another without changing the value, as 2 lb. 8 oz. may be expressed as 2½ lb., or as 40 oz.

7. In changing 2 lb. 8 oz. to ounces we change to a lower denomination. This process is called **reduction descending.**

8. In changing 40 oz. to pounds we change to a higher denomination. This process is called **reduction ascending.**

TABLES FOR STUDY AND REFERENCE

LIQUID MEASURE

4 gills (gi.) = 1 pint (pt.)
2 pints = 1 quart (qt.)
4 quarts = 1 gallon (gal.)

A gallon contains 231 cu. in.

For general purposes it is sufficiently accurate to call 7½ gal. equal to a cubic foot. 31.5 gal. are considered a barrel, and 2 bbl. a hogshead.

DRY MEASURE

2 pints (pt.) = 1 quart (qt.)
8 quarts = 1 peck (pk.)
4 pecks = 1 bushel (bu.)

A bushel, even measure, contains 2150.42 cu. in.

A bushel, heaped measure, contains 2688 cu. in. It is sufficiently accurate to say there are 1¼ cu. ft. in an even bushel, and 1½ cu. ft. in a heaped bushel. The even bushel is used in measuring all kinds of grain and the heaped bushel in measuring all kinds of fruits or vegetables.

MEASURE OF LENGTH OR LONG MEASURE

12 inches (in.) = 1 foot (ft.)
3 feet = 1 yard (yd.)
5½ yards or 16½ feet = 1 rod (rd.)
320 rods or 5280 feet = 1 mile (mi.)

NOTE: — 6′ is often written for 6 ft., and 6″ for 6 in.

A *hand* is 4 in., used in measuring the height of horses.

A *fathom* is 6 ft., used in measuring the depth of water.

A *knot* or nautical mile is 1.15 miles, and a *league* is 3 miles, both used in measuring distances at sea.

A *pace* is 3 ft., used in estimating distances.

A *chain* is 66 ft., used by surveyors.

MEASURE OF SURFACE OR SQUARE MEASURE

144 square inches (sq. in.) = 1 square foot (sq. ft.)
9 square feet = 1 square yard (sq. yd.)
30¼ square yards = 1 square rod (sq. rd.)
160 square rods = 1 acre (A.)
640 acres = 1 square mile (sq. mi.)

A *section* of land is 1 mile square.

A *square* is 100 sq. ft. of roofing.

MEASURE OF VOLUME OR CUBIC MEASURE

1728 cubic inches (cu. in.) = 1 cubic foot (cu. ft.)
27 cubic feet = 1 cubic yard (cu. yd.)
128 cubic feet = 1 cord (cd.)

A *perch* is usually 24¾ cu. ft., used in measuring stones and masonry.

A *load* is 1 cu. yd., used by contractors in excavating earth for cellars, etc.

A *brick* is 8 in. long, 4 in. wide, and 2 in. thick; 22 bricks are estimated as equal to 1 cu. ft.

MEASURE OF WEIGHT OR AVOIRDUPOIS WEIGHT

16 ounces (oz.) = 1 pound (lb.)
100 pounds = 1 hundredweight (C.)
2000 pounds = 1 ton (T.)

A *long ton* is 2240 lb., used in buying coal at the mine and by custom-house offices in collecting duties. A barrel of flour weighs 196 lb. A bushel of oats weighs 32 lb., corn 56 lb., wheat or potatoes 60 lb.

TABLE OF TIME MEASURE

60 seconds (sec.) = 1 minute (min.)
60 minutes = 1 hour (hr.)
24 hours = 1 day (d.)
7 days = 1 week (wk.)
12 months (mo.) = 1 year (yr.)

"Thirty days hath September
April, June, and November."

The other months have 31 days, except February, which has 28 days in common years and 29 days in leap years. All years divisible by 4 are leap years except centennial years, these only are leap years when divisible by 400.

A *decade* is 10 years, and a *century* is 100 years.

TABLE OF VALUE OR UNITED STATES MONEY

10 mills = 1 cent (ct. or ¢)
10 cents = 1 dime
10 dimes = 1 dollar ($)

The mill is not coined, but we frequently use the term in speaking of fractional parts of a cent.

TABLES FOR COUNTING

20 units = 1 score
12 units = 1 dozen (doz.)
12 dozen = 1 gross (gro.)
24 sheets of paper = 1 quire
20 quires = 1 ream

Paper is often sold by the pound instead of the quire or ream.

A folio is paper folded into 2 leaves in making books; a quarto or 4to is folded into 4 leaves; an octavo or 8vo into 8 leaves, and a duodecimo or 12mo into 12 leaves.

The tables of Troy Weight, used by goldsmiths, and Apothecaries Weight, used by physicians and druggists, are of too little importance to include them in the list of tables. The table for Circular Measure will be presented in connection with Longitude and Time or the study of circles.

REDUCTION. ORAL EXERCISES

Change:

1. 8 bu. to pecks.
2. 3 pk. to quarts.
3. 56 qt. to pecks.
4. 16 pk. to bushels.
5. 12 gal. to quarts.
6. 20 qt. to pints.
7. 36 qt. to gallons.
8. 80 pt. to quarts.
9. 9 ft. to inches.
10. 15 yd. to feet.
11. 33 ft. to yards.
12. 144 in. to feet.
13. 11 yd. to rods.
14. 2 mi. to rods.
15. 8 sq. yd. to square feet.
16. 81 sq. yd. to square feet.
17. 2 acres to square rods.
18. $60\frac{1}{2}$ sq. yd. to square rods.
19. 48 oz. to pounds.
20. 4 lb. to ounces.
21. 120 min. to hours.
22. 5 hr. to minutes.
23. 84 days to weeks.
24. 10 yr. to months.
25. 48 hours to days.
26. 3 min. to seconds.
27. 4 score to units.
28. 5 reams to quires.
29. 1 gross to units.
30. 2 quires to single sheets.

1. Change 20 gal. 3 qt. 1 pt. to pints.

Analysis

1 gal. = 4 qt.
20 gal. = 20 × 4 qt. = 80 qt.
80 qt. + 3 qt. = 83 qt.
1 qt. = 2 pt.
83 qt. = 83 × 2 pt. = 166 pt.
166 pt. + 1 pt. = 167 pints.

Usual Method

$$\begin{array}{rl}
20 & \\
\underline{4} & \\
80 & = \text{the number of quarts in 20 gal.} \\
\underline{3} & \\
83 & = \text{the number of quarts in 20 gal. 3 qt.} \\
\underline{2} & \\
166 & = \text{the number of pints in 83 qt.} \\
\underline{1} & \\
167 & = \text{the number of pints in 83 qt. 1 pt.}
\end{array}$$

Change:

2. 5 reams, 10 quires, 18 sheets, to sheets.
3. 7 T. 25 lb., 12 oz. to ounces.
4. 4 wk. 6 days, 12 hours to hours.
5. 9 hr. 45 min. 50 sec. to seconds.
6. 7 cu. yd. 15 cu. ft. 750 cu. in. to cubic inches.
7. 7½ cords to cubic ft.
8. 3 acres, 40 sq. rd. to square rods.
9. 17 sq. rd. 15 sq. yd. 7 sq. ft. to square feet.
10. 28 sq. yd. 8 sq. ft. 91 sq. in. to square inches.
11. 7 mi. 180 rd. 3 yd. to yards.
12. 160 rd. 4 yd. 2 ft. to feet.
13. 5 mi. 15 ft. to feet.
14. 4 yd. 2 ft. 9 in. to inches.
15. 476 leagues to miles.
16. 96 fathoms to feet.
17. 6 gal. 3 qt. 1 pt. to pints.
18. 3 qt. 1 pt. 2 gi. to gills.
19. 17 bu. 3 pk. to pecks.
20. 24 bu. 2 pk. 7 qt. to quarts.
21. $7, 4 dimes, 8 cents to cents.

1. Draw a line on the blackboard 1 yd. long.

2. Draw a line on the floor 1 rod long. Walk the length of the line counting your steps.

3. In another part of the room *pace* a rod. Measure the distance, correcting the error if any.

4. Cut a string 165 ft. or 10 rd. long. With this measuring string mark off various distances from the schoolhouse, as 40 rd. or $\frac{1}{8}$ m., 80 rd. or $\frac{1}{4}$ m., 160 rd. or $\frac{1}{2}$ m., 1 mile.

5. Practice estimating these different distances, then pace them to correct your estimate.

6. Mark off a square rod on the floor or in the yard.

7. With your measuring string in some park or vacant lot mark off a rectangle 16 rd. × 10 rd., or 20 rd. by 8 rd. This is 1 acre.

8. Compare the schoolyard with the acre. Compare your home lot with the acre.

NOTE: — Give the pupils much practice in visualizing the longer measures of length and surface.

Change:

9. 144 units to dozens.
10. 80 quires to reams.
11. 850 cents to dimes.
12. 600 cents to dollars.
13. 12 leagues to miles.
14. 24 ft. to fathoms.
15. 2 chains to feet.
16. 84 mo. to years.
17. 48 hr. to days.
18. 360 min. to hours.
19. 8000 lb. to tons.
20. 84 gills to pints.
21. 320 qt. to pecks.
22. 22 yd. to rods.
23. 165 ft. to rods.
24. 36 ft. to yards.
25. 1280 A. to square miles.
26. $90\frac{3}{4}$ sq. yd. to square rods.
27. 15 gal. will fill how many cubic feet?
28. 4 heaped bushels will fill how many cubic feet?
29. 8 even bushels will fill how many cubic feet?
30. 9 cu. yd. will make how many loads?

1. Reduce 167 pints to gallons, quarts, and pints.

$$\begin{array}{l} 2\underline{)167} \text{ pt.} \\ \;\;4\underline{)83} + 1 \text{ pt.} \\ \;\;\;\;20 + 3 \text{ qt.} \\ 20 \text{ gal. } 3 \text{ qt. } 1 \text{ pt.} \end{array}$$

Since 2 pt. equal 1 qt., 167 pt. will equal 83 qt. and 1 pt. remaining.

Since 4 qt. equal 1 gal., 83 qt. will equal 20 gal. and 3 qt. remaining. Hence 167 pt. = 20 gal. 3 qt. 1 pt.

Reduce to units of higher denomination:

2. 211 gills
3. 193 pt. (liquid)
4. 87 pt. (dry)
5. 124 qt. (dry)
6. 236 oz.
7. 9236 lb.
8. 2348 sec.
9. 3245 min.
10. 1920 hr.
11. 4672 in.
12. 162 ft.
13. 95 yd.
14. 2958 rd.
15. 2046 sq. in.
16. 248 sq. ft.
17. 286 sq. yd.
18. 815 sq. rd.
19. 76½ pk.
20. 8463 cu. in.
21. 374 cu. ft.
22. 4515 lb.

23. How many pounds are there in $\frac{5}{8}$ of a ton?
Solution: $\frac{5}{8}$ of 2000 lb. = 1250 lb.

24. In $\frac{11}{12}$ gal. there are how many quarts?

25. In $\frac{3}{7}$ mi. there are how many rods?

26. How many pecks are there in $\frac{3}{4}$ bu.?

27. Change $\frac{5}{7}$ cu. yd. to cubic feet.

28. Change $\frac{3}{5}$ A. to square rods.

29. Change .8$\frac{1}{3}$ yd. to feet.
Solution: 3 ft. multiplied by .8$\frac{1}{3}$ = 2.5 ft.

30. Change .6875 gal. to quarts.

31. Change .75 yr. to months.

32. Change .625 hr. to minutes.

33. How many days are there in $\frac{1}{2}$ of a week?

34. $\frac{1}{5}$ of a day is how many hours and minutes?

35. In .375 gal. there are how many quarts?

36. Change .625 sq. mi. to square rods.

1. Add : 4 bu.
5 bu.
9 bu.

2. Add : 3 pk.
2 pk.
5 pk.

3. Add : 7 qt.
5 qt.
12 qt.

4. Add :

4 bu.	3 pk.	7 qt.
5 bu.	2 pk.	5 qt.
9 bu.	5 pk.	12 qt.
10 bu.	2 pk.	4 qt.

The first three examples are arranged in the fourth as parts of one compound number. The result of the addition is 9 bu. 5 pk. 12 qt. 12 qt. = 1 pk. 4 qt. Write the 4 qt. Unite the 1 pk. with 5 pk. making 6 pk. 6 pk. = 1 bu. 2 pk. Write the 2 pk. and unite the 1 bu. with the 9 bu. making 10 bu.

5. Add : 18 gal. 3 qt.; 60 gal. 3 qt. 1 pt.; 61 gal. 3 qt.; 57 gal. 3 qt. 1 pt.

6. Add : 15 da. 23 hr. 55 min. 17 sec.; 13 da. 15 hr. 17 min. 38 sec.; 10 da. 23 hr. 42 min. 12 sec.

7. Add :

mi.	rd.	ft.	in.
21	295	11	1
45	279	10	11
35	214	9	10

8. Add :

bu.	pk.	qt.
85	3	7
9	2	5
98	0	6

9. How much wood is there in three piles, if the first contains 12 cd. 17 cu. ft., the second 9 cd. 12 cu. ft., and the third 20 cd. 98 cu. ft.?

10. Add : 57 A. 25 sq. rd.; 129 A. 15 sq. yd.; 37 A. 50 sq. rd. 13 sq. yd.; 75 A. 12 sq. yd.

11. Add : 5 gal. 3 qt. 1 pt.; 9 gal. 1 qt. 1 pt.; 7 gal. 3 qt. 1 pt.; 5 gal. 2 qt.

12. Add : 12 bu. 2 pk. 5 qt.; 15 bu. 3 pk. 3 qt.; 29 bu. 2 pk.; 17 bu. 2 qt.

13. Add: 24 rd. 5 yd. 1 ft.; 4 yd. 10 in.; 86 rd. 3 yd. 2 ft.

14. Add : 110 cu. yd. 7 cu. ft.
78 cu. yd. 13 cu. ft.
94 cu. yd. 21 cu. ft.
108 cu. yd. 11 cu. ft.

15. Add : 17 T. 125 lb.
34 T. 750 lb.
19 T. 800 lb.
76 T. 500 lb.

1. Take 8 bu. 3 pk. 7 qt. from 15 bu. 1 pk. 5 qt.

$$\begin{array}{rrr} 15 \text{ bu.} & 2 \text{ pk.} & 5 \text{ qt.} \\ 8 \text{ bu.} & 3 \text{ pk.} & 7 \text{ qt.} \\ \hline 6 \text{ bu.} & 2 \text{ pk.} & 6 \text{ qt.} \end{array}$$

or

$$\begin{array}{rrr} 14 \text{ bu.} & 5 \text{ pk.} & 13 \text{ qt.} \\ 8 \text{ bu.} & 3 \text{ pk.} & 7 \text{ qt.} \\ \hline 6 \text{ bu.} & 2 \text{ pk.} & 6 \text{ qt.} \end{array}$$

Since we cannot take 7 qt. from 5 qt., we take 1 pk. from the 2 pk. and put it with 5 qt., making 13 qt. 13 qt. − 7 qt. = 6 qt. In the same way 1 bu. is changed to pecks and united with 1 peck, making 5 pk. 5 pk. − 3 pk. = 2 pk. 14 bu. − 8 bu. = 6 bu. If thought best, 15 bu. 2 pk. 5 qt. may be changed immediately to 14 bu. 5 pk. 13 qt., as in the second illustration.

2. From 46 gal. 1 qt. 1 pt. take 25 gal. 2 qt. 1 pt.

3. Take 160 T. 1800 lb. from 175 T. 298 lb.

4. From 8 bu. 1 pk. 6 qt. take 3 bu. 2 pk. 4 qt.

5. From 471 cu. yd. 16 cu. ft. take 115 cu. yd. 17 cu. ft.

6. From 19 yr. 5 mo. take 12 yr. 9 mo.

7. How long was it from July 15, 1907, to Feb. 6, 1909?

$$\begin{array}{rrr} 1909 \text{ yr.} & 2 \text{ mo.} & 6 \text{ d.} \\ 1907 \text{ yr.} & 7 \text{ mo.} & 15 \text{ d.} \\ \hline 1 \text{ yr.} & 6 \text{ mo.} & 21 \text{ d.} \end{array}$$

From the 6th day of the second month of 1909 take the 15th day of the seventh month of 1907. Take one of the 2 mo., which is 30 d., and unite it with the 6 d., making 36 d. 36 d. − 15 d. = 21 d. Take one year, or 12 mo., and unite it with 1 mo., making 13 mo. 13 mo. − 7 mo. = 6 mo. 1908 yr. − 1907 yr. = 1 yr.

Find the difference in time between:

8. June 8, 1907 and Aug. 15, 1910.

9. Feb. 23, 1906 and April 6, 1909.

10. Jan. 5, 1907 and March 26, 1910.

11. Sept. 15, 1908 and March 16, 1910.

12. Apr. 18, 1909 and Jan. 25, 1911.

13. Nov. 13, 1908 and May 2, 1911.

14. A man sold 42 T. 1500 lb. of hay from a mow containing 64 T. How much hay remained?

15. Subtract your birthday from to-day and find your exact age in years, months, and days.

LESSON 193 *MULTIPLICATION OF COMPOUND NUMBERS*

1. Multiply 7 bu. 3 pk. by 6.

7 bu. 3 pk.
6
42 bu. 18 pk.
46 bu. 2 pk.

Multiply each denomination separately. The result is 42 bu. 18 pk. Beginning with the lowest denomination, change, when possible, to the next higher denomination. 18 pk. = 4 bu. 2 pk. Write the 2 pk. and add the 4 bu. to 42 bu.

2. What is the weight of 9 loads of hay, each weighing 1 T. 545 lb.?

3. If it takes 4 days 5 hr. to build a machine, how long will it take to build 24 machines?

4. How much wood is there in 12 piles, each containing 10 cd. 50 cu. ft.?

5. If a man can build 11 rd. 7½ ft. of fence in a day, how much can 8 men build?

6. If 16 automobiles in the Glidden endurance test of 1909 stopped at Station B, and each received 6 gal. 3 qt. of gasoline, how much gasoline did all receive?

7. A driving track measures 180 rd. 10 yd. in length. How much more than 2 miles has a horse traveled in going round this track 4 times?

8. Multiply 5 ft. 3 in. by 4 ft. 6 in.

63 sq. in.
54
144)3402 sq. in.
23.625 sq. ft.

Reduce the compound numbers to the same denomination. 5 ft. 3 in. = 63 in. 4 ft. 6 in. = 54 in. (63 × 54) sq. in. = 3402 sq. in. 3402 sq. in. ÷ 144 sq. in. = 23.625, hence there are 23.625 sq. ft.

Find the area of:

		Base.	Altitude.
9.	A rectangle	17 ft. 2 in.	15 ft. 6 in.
10.	A triangle	13 ft. 9 in.	10 ft. 4 in.
11.	A rectangle	40 rd. 5 yd.	24 rd. 4 yd.
12.	A triangle	18 yd. 1 ft.	16 yd. 2 ft.
13.	A rectangle	12 rd. 9 ft.	8 rd. 8 ft.

1. Divide 50 bu. 4 pk. by 6.

$$\begin{array}{r}
8\text{ bu. }2\text{ pk.}\\
6\overline{)50\text{ bu. }4\text{ pk.}}\\
\underline{48\text{ bu.}}\\
2\text{ bu.}\\
\underline{4}\\
8\text{ pk.}\\
\underline{4\text{ pk.}}\\
12\text{ pk.}\\
12\text{ pk.}
\end{array}$$

⅙ of 50 bu. = 8 bu. and 2 bu. remaining. Write the 8 bu. above the bushels. The remaining 2 bu. = 8 pk. 8 pk. + 4 pk. = 12 pk. ⅙ of 12 pk. = 2 pk. The result is 8 bu. 2 pk.

Divide:

2. 17 hr. 32 min. 24 sec. by 4.

3. 23 sq. yd. 9 sq. ft. 117 sq. in. by 9.

4. 89 bu. 1 pk. 7 qt. by 7.

5. 332 lb. 8 oz. by 19.

6. 115 T. 476 lb. 12 oz. by 28.

7. 36 gal. 3 qt. 1 pt. by 9.

8. Divide 13 ft. 6 in. by 4 ft. 6 in.

$$\begin{array}{r}
3\\
54\text{ in.}\overline{)162\text{ in.}}\\
\underline{162}
\end{array}$$

Change both numbers to the same denomination. 13 ft. 6 in. = 162 in. 4 ft. 6 in. = 54 in. 54 in. is contained in 162 in. 3 times.

9. How many packages containing 2 lb. 4 oz. can be made from 11 lb. 4 oz.?

10. If the circumference of a carriage wheel is 9 ft. 6 in., how many revolutions will the wheel make in going a mile?

11. The area of a rectangle is 137 sq. ft. 72 sq. in. If the length is 16 ft. 6 in., what is the width?

12. The area of a rectangle is 114¾ sq. ft. If the length is 25 ft. 6 in., what is the width?

13. How many planks, each 4 ft. 8 in. long, will it take to reach 38 ft.?

1. The length of a rectangle is 1 rd. 5 ft. and its width is 66 in. Find the length and width in feet and its area in square feet.

2. A horse is 13½ hands high. How many inches high is it? How many feet and inches?

3. What is the breadth of a rectangular field containing 7½ acres, if the length is 242 yards?

4. A rectangular yard is 28 ft. 8 in. long and 24 ft. 9 in. wide. How many square feet are there in its area? What will it cost to sod it at 75¢ a square yard?

5. How many rods of fence will enclose a rectangular field of 20 acres, if its width is 40 rd.?

6. A pile of wood 9 ft. high and 4 ft. wide contains 20 cords. How long is it?

7. How many cubic feet of ice are there on a pond covering 1 acre, if the ice is 1¼ ft. thick? If a cubic foot of ice weighs 57 lb. 8 oz., how many tons will this ice weigh?

8. If ice retails at 40¢ a hundred, find the value of the ice on the pond.

9. From a lot of land 40 rd. square, 40 square rods were sold. How many square rods remained? Find its value at $120 an acre.

10. Find the number of cubic feet in a rectangular prism 12½ yd. by 10 ft. by 16 in.

11. Find the circumference of a circle whose diameter is 75 feet. Find the area of the same circle.

12. At $1.20 a bushel find the cost of 12 bu. 3 pk. 1 qt. of beans.

13. What is the cost of 6340 lb. of coal at $6.25 a ton?

14. Change 948,741 min. to higher denominations.

15. Reduce 5 gal. 2 qt. 1 pt. to pints.

16. Find the time from Nov. 29, 1909, to April 1, 1911.

17. Find the area of a triangle 6⅔ yd. long, if the altitude is 8 ft. 4 in.

1. A merchant sold his horse for $200 and by so doing lost 20%. Find the value of the horse.

2. Grace gave ½ of her oranges to her mother and ⅓ of them to her father. What part did she keep? What per cent had she left?

3. If you sell an article for 12½¢ that cost 10¢, how much will you gain? What will be your rate of gain?

4. When there is neither gain or loss what is the selling per cent?

5. What is the amount of $60 for 60 days?

6. What is the interest on $100 for 1 yr.? For 2 yr.? 1 yr. 6 mo.? 2 yr. 3 mo.?

7. A grocer sold tea at 50¢ a pound and gained 25%. The tea cost —— a pound.

8. Ten bushels out of 100 bushels is what per cent?

9. $1 out of every $10 is what per cent?

10. $5 out of every $20 is what part? Is how many hundredths? Is what per cent?

11. A man receiving a salary of $2400 spends 33⅓% of it for expenses. His expenses are ——.

12. ⅖ of $1 equals —— hundredths of it. This is ——% of it.

13. ½ of a farm is —— hundredths of it. It is what per cent of it?

14. If 18 is 6% of some number, what is 1% of it? What is 100% of it? What is the number?

15. If 5 is 33⅓% of a number, it is what part of the number? Then $\frac{3}{3}$ or the number is ——.

16. Express as decimals, 6%, 25%, 12½%, 150%, 275%, 0.5%, 0.1½%.

17. A foot is what per cent of a yard?

18. An inch is what per cent of a foot?

19. A quart is what per cent of a gallon?

1. A man paid $2500 for a piece of property and sold it at a discount (loss) of 20%. What was the discount and how much did he receive for it?

2. A typewriter was bought for $80 and sold at a discount of 12½%. Find the selling price.

3. From a lot of 350 chickens 24% were sold. How many chickens remained?

4. A merchant bought $900 worth of goods at 7% discount. How much did he pay for the goods?

5. A man sold a piece of property at a profit of $700, which was 35% of the cost. What did he receive for it?

6. A man sold 33 sheep, which was 44% of his whole flock. How many did he have left?

7. There are 760 pupils in a school. If 55% of them are boys, how many girls are there?

8. A grocer bought 112 barrels of flour at $4.25 a barrel and sold them at a profit of 24%. Find the selling price per barrel and the gain on the lot.

9. A dealer bought horses at $120 and sold them at $185 each. What per cent profit did he gain?

10. A merchant sold 75 yd. of silk that cost $1.10 a yard at a gain of 50%. Find the selling price a yard and the gain on all the silk.

11. A man receives a salary of $1600. If he spends 68% of it each year, how much can he save in 5 years?

12. A woman spent 19% of her money for a suit that cost. $47.50. How much money did she have left?

13. A grocer bought flour for $350 and sold it at a profit of 24%. Find the sum received for it.

14. If 65% of a ton of hay is worth $10.92, how much must be paid for 45% of a ton?

15. Find the interest on $252.64 for 3 yr. 9 mo. 19 d. at 7%.

16. Find the interest on $539.50 for 2 yr. 5 mo. 16 d. at 4%.

1. A sailor took the sounding and found the water 10 fathoms deep. How many feet deep was the water?

2. If we add ⅛ of a number to itself, the sum will be how many eighths of itself? If the sum is 36, what is the number?

3. If we increase a number by ⅗ of itself, the sum will be 80. What is the number?

4. A man spent ⅗ of his money for a horse. How many fifths did he have left? If he had $80 left, how much money had he at first? How much did the horse cost?

5. My brother's age diminished by 7 years equals 15 years. How old is my brother?

6. A boy spent ⅕ of his money for candy and ¼ for peanuts. What part did he spend? What part had he left? If he had 44¢ left, how much money had he at first?

7. Divide the number 42 into two such parts that one part may be five times the other part.

8. A pole increased by ⅕ of its own length would be 18 ft. long. What is its length?

9. Six men can do a piece of work in 9 days. 18 men can do it in —— days. 18 men are —— times 6 men, therefore they can do the work in —— —— of the time.

10. What is the cost of 2 doz. books at 33⅓¢ each?

11. At 33⅓¢ each, how many books can be bought for $9?

12. ¼ of 80 is how many times ⅙ of 30?

13. Four boys contributed 30 cents each, and bought some melons at 10¢ each. How many did they buy?

14. If 9 yd. of muslin cost $1.50, how much will 27 yd. cost? 27 yd. are —— times 9 yd., therefore 27 yd. will cost —— times $1.50 = $ ——.

15. How many baskets holding 2 pk. each will 5 bu. of peaches fill?

16. 24 is 60% of what number?

17. If cloth cost $5 a yard, how much can you buy for $2½?

18. Find the interest on $500 for 120 days.

1. A can do a piece of work in 6 days, B in 7, and C in 8. In what time can they do it working together?

2. If the diameter of my carriage wheel is $4\frac{1}{2}$ ft., how many revolutions will it make in going 2 miles and back again?

3. At $1.85 a yard, find the cost of carpet 1 yd. wide to cover the floor of a room 22 ft. long, 19 ft. wide, if the strips run lengthwise.

4. How many 4-oz. bottles ($\frac{1}{4}$ pt.) can be filled from 4 gal. 2 qt. 1 pt. of alcohol?

5. Find the cost of 80 pieces of maple flooring, 3 in. wide, 16 ft. long, at $38.50 per M. 100 pieces, 4 in. wide, 15 ft. long, at $35 per M. 48 boards, 10 in. wide, 18 ft. long, at $28.75 per M.

6. Find the interest on $248 for 90 days at 7%.

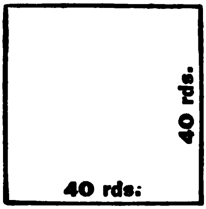
7. Find the interest on $636 for 1 yr. 5 mo. 10 d. at 5%.

8. If a man, who earns $90 a month, pays $72 a month for expenses, what per cent of his money can he save?

9. A flour mill made 5280 barrels of flour in a week. $12\frac{1}{2}$% of it was sold to one grocer, $33\frac{1}{3}$% of the remainder to another, and 50% of what was then left to another. How many barrels were then left? If the remainder was sold for $4666.20, what was the price a barrel?

10. Change $\frac{1}{4}$, $9\frac{1}{8}$, $\frac{2}{5}$, $\frac{3}{24}$, $5\frac{1}{2}$, to decimals and add.

11. What will 1200 lb. of hay cost at $18.50 a ton?



12. If the posts are set 8 ft. apart, how many posts will be needed for the fence for this field? Find their value at $28 per C.

13. If the fence is 5 boards high and each board is 16 ft. long, how many boards will it take for the fence?

14. If each board is 10 in. wide, find the cost of the boards at $17 per M.

15. Find the entire cost of the fence, if the labor of making cost $40.

1. If A man spends $\frac{3}{4}$ of his income, what per cent of his income does he spend?

2. For how much must a merchant sell goods that cost $25, so as to gain 20%?

3. How do you find the radius of a circle when you know its circumference?

4. What two dimensions of a triangle do you need to know to find the area?

5. When these two dimensions are given, how do you find the area of a triangle?

6. How would you find the cost of the sidewalk in front of your house, if you knew the cost of a square yard?

7. State each step necessary in finding the number of yards of carpet needed to cover any room.

8. How many dimensions has a solid? Name them.

9. How many dimensions do you need to know to find the volume of a solid?

10. When you know the number of cords in a pile of wood and the width and height of the pile, how do you find the length?

11. A pile of wood is 16 ft. long, 4 ft. wide, and 4 ft. high. Can you tell how many cords there are in the pile without finding the number of cubic feet? How many cords are there?

12. A wheel is 16 ft. in circumference and made 10 revolutions in going from A to B. What can you find from this statement?

13. A wheel turns 3 times in going 45 ft. What can you find from this statement?

14. Write the table for long measure. Show how the table for square measure can be developed from the table of long measure.

15. What will 40 pt. of milk cost at 5¢ a quart?

16. $36 is $\frac{6}{7}$ of the cost of an encyclopedia. Find the cost of 2 encylopedias at the same rate.

17. If $2\frac{1}{4}$ bbl. of apples cost $8.10, what will 1 bbl. cost?

1. At $3.50 a cord find the value of a pile of wood 64 ft. long, 4 ft. wide, and 6 ft. high.

2. A lady wishes to buy a carpet for a room 14 ft. long and 11 ft. wide. She has already a border of carpet 1 ft. wide all round the room. How many square yards of carpet must she buy?

3. Change 37 sq. yd. 9 sq. ft. 38 sq. in. to square inches.

4. A rug 5 yd. by 4 yd. is in the center of a room. There is a strip 18 in. wide round the room still uncovered. Find the square feet in the room. Find the square feet in the rug. Find the square feet in the part uncovered.

5. How many feet of lumber are there in 40 boards, 20 ft. long, 1 ft. 6 in. wide?

6. A merchant sold cloth at $2.20 a yard, for which he paid $1.88 a yard. How many yards must he sell at the same rate to gain $19.20?

7. A wholesale grain dealer invested $48,000 in wheat at 80¢ a bushel, 50% as much money in corn at 60¢ a bushel, and 20% as much money in oats at 50¢ a bushel. How much money did he invest in corn? How much in oats? How much in all?

8. How many bushels did he buy of wheat? How many of corn? How many of oats? How many bushels of grain did he buy?

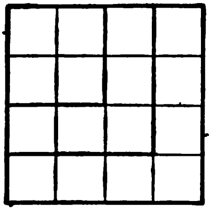
9. The minuend is 487,520, and the subtrahend is 79,026. What is the remainder?

10. At 50¢ a load find the cost of digging a cellar 27 ft. long, 18 ft. wide, and 6 ft. deep.

11. If $13\frac{1}{2}$ bu. of corn cost $\$6\frac{1}{4}$, what will $6\frac{1}{5}$ bu. cost?

12. A man divided a field containing 16 acres into lots containing 40 square rods each. How many lots were there? If the lots were sold at $175 each, how much money was received?

13. A mill is worth $9900, a house $3000, and a farm $\frac{7}{12}$ of the difference between the value of the house and the mill. Find the value of all.



Scale ¼

1. From Fig. 1, show how many square inches there are in a 2-in. square. In a 3-in. square. In a 4-in. square.

2. 4 is called the *square* of 2.

3. The **square** of a number is the product obtained by multiplying the number by itself.

4. From the figure above, show the square of 3. The square of 3 is ——.

5. What is the square of 4?

6. Multiply 5 by itself. What is the result?

7. Make a drawing to illustrate the square of 6.

8. Use 7 as a factor twice. This means multiply 7 by itself. 49 is the —— of 7.

9. Square 8. This means find the square of 8. The square is ——.

10. The square of 9 is ——.

11. 10^2. This means $10 \times 10 =$ ——.

12. The little figure 2, placed at the right and above the number, is called the **exponent**. It tells us how many times 10 is to be used as a factor.

13. $12^2 =$ ——. $8^2 =$ ——. $9^2 =$ ——.

14. Find 2 equal factors of 4. Of 9. Of 16.

15. 2 is called the *square root* of 4. 3 is the *square root* of 9. What is the square root of 16?

16. The **square root** of a number is one of the 2 equal factors of the number.

17. Find the square root of 25. Of 49. Of 81.

18. Find one of the two equal factors of 36. Of 64. Of 81.

19. A square piece of paper contains 144 square inches. It measures —— in. on a side.

20. A square garden is 9 rd. on a side. It contains —— square rods.

1. Write all the perfect squares between 1 and 144.

2. Is 15 a perfect square? Name the 2 factors.

3. Find the area of a square park that is 24 rd. long.

4. There are 256 square feet in a square plot of ground. If it is 16 ft. long, how wide is it?

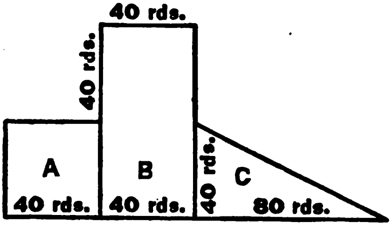
5. There are 320 square yards in a rectangular garden. If it is 16 yd. wide, how long is it?

6. How many feet of boards will be needed to roof and board the walls of a building 60½ ft. long, 40 ft. wide, and 22 ft. high to the eaves? The rafters are 23 ft. 3 in. long and the gable ends are 10 ft. high.

7. How many pickets 3 in. wide and nailed 3 in. apart will be used in fencing a lot 150 ft. by 60 ft.?

8. The triangular gable of a house has a base of 44 ft. and an altitude of 18 ft. How many square feet of boards will cover the two gables?

9. What is the perimeter of a rectangular field whose length is twice its breadth, if the breadth is 28 rd. 4 yd.?



10. This is the shape of Mr. Dexter's farm. Find the area of each of the three fields.

11. Find the area of the whole farm.

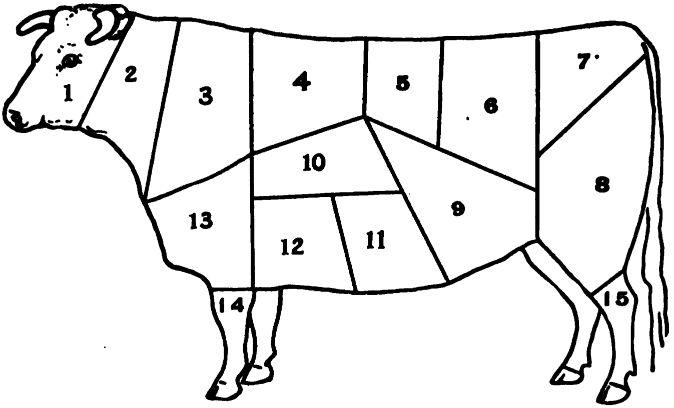
12. How does the area of A and C compare with the area of B?

13. Find the value of the farm at $80 an acre.

14. An auditorium in a public building is 40 ft. long and 36 ft. wide. Find the number of square feet in the floor and ceiling.

15. If the walls are 18 ft. high, find the square feet in the walls.

16. Find the square feet in the walls, ceiling, and floor.



1. Head, 6¢, 15 lb.
2. Neck, 10¢, 25 lb.
3. Chuck, 14¢, 135 lb.
4. Prime Ribs, 18¢, 60 lb.
5. Porterhouse Steak, 28¢, 80 lb
6. Sirloin Steak, 22¢, 35 lb.
7. Rump, 16¢, 30 lb.
8. Round, 18¢, 130 lb.
9. Flank, 8¢, 30 lb.
10. Short Ribs, 8¢, 25 lb.
11. Plate, 7¢, 80 lb.
12. Brisket, 10¢, 75 lb.
13. Shoulder Clod, 16¢, 60 lb.
14. Shin, 7¢, 40 lb.
15. Shank, 8¢, 22 lb.

This diagram shows the manner of cutting beef. The table gives the names of the parts and the present retail price, and the approximate weight.

1. Find the weight of this steer, and its value at retail.

2. If the live weight was 40% greater than the retail weight, and the market-man paid 8¢ live weight, find how much he paid.

3. Find his total gain if his expenses for handling were $10.

4. The following quantities of meat were used in the cooking room in one week. Find the cost for each day and for the week. Monday 6 lb. of neck for stew; Tuesday, 4½ lb. ribs for roast; Wednesday, 6 lb. rump for pot roast; Thursday, 3 lb. round for Hamburg steak; Friday, 3 lb. shin bone for stew.

5. A boarding house used the following amount of beef in a week. Find its total cost. 12½ lb. of Porterhouse steak; 24 lb. rib roast; 6½ lb. brisket for corned beef.

PICNIC LUNCH FOR 12 BOYS OR GIRLS.

Chicken Sandwiches.
Hard cooked eggs. Olives.
Bananas. Oranges.
Fudge.

Sandwiches.
Chicken 40¢.
2 loaves bread @ 10¢.
½ lb. butter @ 32¢.

1 doz. eggs @ 34¢.
2 bottles olives @ 15¢.
1 doz. bananas @ 20¢.
1 doz. oranges @ 30¢.

Fudge.
1 lb. white sugar @ 6¢.
1 lb. brown sugar @ 5¢.
½ pt. milk @ 8¢ qt.
2 oz. chocolate @ 40¢ lb.
3 oz. butter @ 32¢ lb.
Vanilla 2¢.

NOTE: — In the following examples, count fractions of a cent in each case as a whole cent.

1. How much does this picnic lunch cost for 12 children?

2. Find the cost for a room, containing 48 pupils.

3. Find the cost for this lunch when four rules of fudge are made and 2 times as many sandwiches.

Sponge Cake.
6 eggs @ 36¢ doz.
½ lb. sugar @ 6¢ lb.
⅜ lb. flour @ 4¢ lb.
Lemon juice 2¢.

Peanut Candy.
1 lb. sugar @ 6¢.
3 pt. peanuts @ 5¢ qt.

Peanut Cookies.
3 oz. butter @ 32¢ lb.
⅜ lb. sugar @ 6¢.
1 egg @ 36¢ doz.
Baking powder and salt 2¢.
¼ lb. flour @ 4¢.
⅛ cup ($\frac{1}{16}$ pt.) milk @ 8¢ qt.
1 pt. peanuts @ 5¢. qt.

At a sale some girls made 10 rules of fudge, each rule weighing 2 lb., and 12 rules of peanut candy, each weighing 1½ lb. Other girls made 6 rules of peanut cookies, each rule making 2 doz. cookies, and others made 10 loaves of sponge cake.

4. Find the total cost of this material.

5. Find the total received when sold at the following prices: Candy 40¢ a pound, cookies 18¢ a dozen, and cake 30¢ a loaf.

BREAKFAST FOR FOUR PERSONS.

Oranges.
Cocoa.
Wheatena with Dates.
Toast.

1. Find the entire cost of the breakfast, if the following materials were used: counting fractions of a cent in each case as a whole cent.

2 oranges @ 30¢ doz.
4 oz. sugar @ 6¢ lb.
2 oz. dates @ 10¢ lb.
¾ loaf bread @ 5¢.

⅓ pkg. Wheatena @ 24¢.
1½ qt. milk @ 7¢.
⅛ can cocoa @ 24¢.
2 oz. butter @ 32¢ lb.

DINNER FOR SIX PERSONS.

Cream of Tomato Soup.
Hamburg Steak.
Baked potatoes. Macaroni and cheese.
Bread. Butter.
Custard Pudding.

Cream of Tomato Soup.
1 can tomatoes @ 15¢.
4 oz. butter @ 32¢ lb.
1 oz. flour @ 4¢ lb.
Salt, pepper, and soda 2¢.
1 qt. milk @ 7¢.

Custard Pudding.
⅛ lb. rice @ 10¢.
2 cups (1 pt.) milk @ 8¢ qt.
2 eggs @ 36¢ doz.
⅛ lb. sugar @ 6¢.
Vanilla and salt 3¢.

Macaroni and Cheese.
⅓ pkg. macaroni @ 15¢.
4 oz. butter @ 32¢ lb.
1 oz. flour @ 4¢ lb.
Salt and pepper, 1½¢.
1 cup milk @ 8¢ qt.
¼ lb. cheese @ 20¢ lb.
¼ loaf bread @ 5¢.

2 lb. steak @ 16¢.
1 qt. potatoes @ 32¢ pk.
Fuel 5¢.

2. Find the total cost of the dinner, and the average for each person. Count fractions of a cent in each case as a whole cent.

3. How much would the cost be reduced if the soup was omitted?

4. How much more would this dinner have cost the family, if bought at a restaurant at 35¢ each?

If 16 cd. of wood cost $96, what will 25 cd. cost?

a. Read the problem carefully, noting what is given; thus, I know that 16 cd. cost $96.

b. Read the problem again, noting what is required; thus, I am asked to find the cost of 25 cd.

c. What do I need to know before I can find what is required?

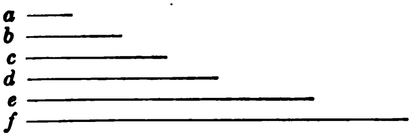
d. Plan the solution, thus: $\frac{\$96}{16} \times 25 = \$$ ——.

e. Ask, "Is the result reasonable?" Thus 25 cd. is a little more than 1½ times 16 cd. The result must be a little more than 1½ times $96. Is it?

NOTE: — Notice what you are to discover each time you read the problem. In many problems the answer to *c* will be nothing, as you can find directly what is required from what is given. Plan the complete solution in advance and use cancelation when possible. Always take the fifth step. By estimating the answer either in advance or at the end of the work you will avoid nonsensical answers and find many errors. This will tend to make you more accurate, which is so essential in arithmetic.

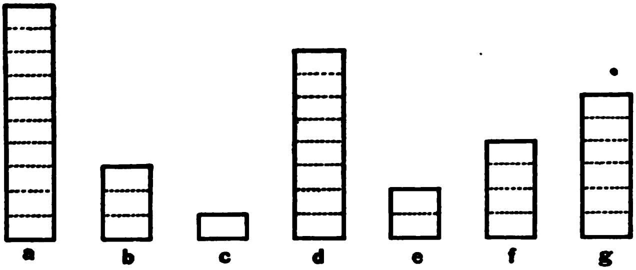
Solve the following problems by this method:

1. If 7 tons of coal cost $35, what will 4 tons cost?
2. If a bushel of beans weighs 60 lb. and a barrel holds 3 bu., how many barrels will it take to hold 5 tons?
3. My sister Alice hires a bicycle for 30¢ an hour. What must she pay for its use from 10 A.M. to 3.30 P.M.?
4. I hired 4 men to work at $3 a day each. The first worked ½ day, the second ⅚ of a day, the third 2¼ days, and the fourth 1⅙ days. How much must I pay each of them?
5. If 3 bbl. of oil cost $15.75, what will 18⅙ bbl. cost?
6. If I buy a barrel of oil containing 42 gal. for $3.50 and retail it at 12½¢ a gallon, how much do I make?
7. My house cost me $5000, and I pay $16 on each thousand as a tax. If I rent the house for $30 a month, how much more than the tax shall I receive?



1. How does *a* compare in length with *b*? How does *b* compare with *a*?

2. In the same way compare *a* with each of the other lines and each of the other lines with *a*.



3. Compare the **area** of each figure with each of the other figures.

4. The **comparison** of one object or quantity with another object or quantity of the same kind is called **ratio**.

5. Ratio is really the quotient obtained by dividing one number by another, and is expressed in three ways:

a. By the sign of division, as 12 ÷ 3.
b. By the colon, as 12 : 4, read 12 *is to* 4.
c. By a fraction $\frac{12}{4}$.

6. Draw a line 2 in. long. How long will another line be if its ratio to the first line is 4? 6? $\frac{1}{4}$? $\frac{1}{2}$?

7. 3 is the ratio of 6 to ——. $\frac{1}{2}$ is the ratio of 6 to ——.

8. Draw an inch square. Draw an oblong 4 times as long and $\frac{1}{2}$ as wide. What is the ratio of the lengths? Of the widths? Of the areas?

9. Express the relation that 6 bears to 9. Express the relation that 9 bears to 6.

10. What is the ratio of 2 to 6? 8 to 4?

1. Ratio is found by dividing the first number by the second.

2. The first term of a ratio is called the **antecedent**.

3. The second term of a ratio is called the **consequent**.

What is the ratio of:

4. 42 to 6?
5. 8 to 56?
6. $4 to 50 ct.?
7. 1 d. to 2 hr.?
8. 4 mo. to 1 yr.
9. 2 wk. to 2 d.?
10. 1 ft. to 1 yd.?
11. 2 min. to 30 sec.?
12. 4 oz. to 1 lb.?

13. Separate $35 in the ratio of 2 to 3.

$\frac{2}{5}$ of \$35 = \$14.
$\frac{3}{5}$ of \$35 = \$21.

There must be $2 in the first part to every $3 in the second, and there must be $5 each time both amounts are taken out. Therefore, the first part must contain $\frac{2}{5}$ of the total, and the second $\frac{3}{5}$ of the total.

14. A and B together own 824 sheep. The ratio of A's sheep to B's is as 5 to 3. How many sheep has each?

15. How long will it take 5 men to do a piece of work that can be done by 15 men in 9 days? What is the ratio of 15 men to 5 men?

16. Divide $192 between 2 men in the ratio of 13 to 3.

17. Separate 260 in the ratio of 9 to 3.

Find the ratio of:

18. 1.25 : 37.5
19. $2\frac{1}{5} : 3\frac{1}{3}$
20. 2 m. : 640 ft.
21. 6.25 : 2.5
22. $5\frac{3}{4} : 6\frac{1}{2}$
23. 5 wk. : $4\frac{1}{2}$ d.

24. Two men rent a pasture for $104. One puts in 6 cows and the other 2. How much rent should each pay?

25. A man's income is $1400 a year. If the ratio of his expenses to his savings is as 2 to 5, find the amount of his savings.

26. The ratio of the circumference of a circle to its diameter is $3\frac{1}{7}$. What is the circumference of a circle whose diameter is 14 ft.?

27. The ratio of the length of a rectangle to its breadth is 3 to 4. If the perimeter is 56 ft., find the length and the breadth.

1. What is the ratio of 8 to 4? What is the ratio of 6 to 3?

2. These two ratios, being equal, may be written $8:4 = 6:3$. These *two ratios* make a *proportion.*

3. **Proportion** is an expression of an *equality of ratios.* A proportion may be read in this way: The ratio of 8 to 4 equals the ratio of 6 to 3, or 8 is to 4 as 6 is to 3.

4. In the proportion $8:4 = 6:3$, how many ratios are there? Name the antecedent of each ratio. Name the consequent of each ratio,

5. In every proportion the first and fourth terms are called the **extremes,** the second and third terms the **means.** Together they are called the **terms** of the proportion.

6. Name the extremes and means in the proportion in example 4.

7. Multiply the extremes together. Multiply the means together. Compare the two products.

Learn: In every proportion the product of the means equals the product of the extremes.

8. Since this is true, if any three terms of a proportion are given, the other can be found.

9. Either extreme equals the product of the means divided by the other extreme, as $x:4 = 6:3$. $3x = 24$. $x = 8$.

10. Either mean equals the product of the extremes divided by the other means, as $8:x = 6:3$. $6x = 24$. $x = 4$.

Find the missing terms in the following proportions:

11. $4:6 = 8:x$

12. $x:8 = 10:40$

13. $9:x = 7:21$

14. $6:3 = x:11$

15. $8:4 = 12:x$

16. $x:5 = 8:20$

17. $9:5 = x:15$

18. $8:x = 6:12$

19. $10:6 = 6:x$

20. $x:8 = 7:3$

21. $\frac{5}{6}:x = \frac{1}{3}:\frac{1}{5}$

22. $x:\frac{3}{8} = \frac{1}{9}:\frac{1}{3}$

1. If 6 tons of coal cost $28, how many tons can be bought for $84?

$$\$28 : \$84 = 6 \text{ tons} : x \text{ tons}$$

$$\frac{\overset{3}{\cancel{84}} \times 6}{\cancel{28}} = 18 \text{ tons.}$$

Let x = the tons that can be bought, and write the ratio 6 tons: x tons. Since the cost of coal is directly proportional to the quantity, we write our first ratio, $28 (the cost of 6 tons): $84 (the cost of x tons). Our proportion is $28: $84 = 6 tons: x tons. In solving use cancelation.

2. The following are usually directly proportional:

a. Cost of goods to the quantity.
b. Weight to volume.
c. Income to time of labor and to capital.
d. Distance to time.

3. If 6 men can build a wall in 24 days, how long will it take 18 men to build it?

$$18 \text{ men} : 6 \text{ men} = 24 \text{ d.} : x \text{ d.}$$

$$\frac{\cancel{6} \times \overset{8}{\cancel{24}}}{\underset{\cancel{3}}{\cancel{18}}} = 8$$

Let x = the number of days. Write the ratio 24 d.: x d. Since time required is inversely proportional to the number of workmen, we write 18 men (the number for x days): 6 men (the number for 24 days). Canceling we have 8 days.

4. Before beginning work carefully decide whether the numbers are *directly* proportional or *inversely* proportional.

5. If a man earns $48 in 4 mo., how much will he earn in 9 mo.?

6. What will 6 tons of coal cost, if 9 tons cost $54?

7. If 12 men can do a piece of work in 6 days, in how many days can 8 men do it?

8. If 54 bu. of wheat make 12 bbl. of flour, how many barrels of flour will 108 bu. make?

9. If 45 sheep cost $270, what will 165 sheep cost?

10. If 35 acres of land cost $937.50, what will 175 acres cost?

11. If 15 yd. of cloth cost $24, what will 65 yd. cost?

We may write any proportion so that the unknown number will come in any term we wish. We have learned that the result may easily be found. For those who prefer the following method of arranging the ratios is given.

1. A family of 6 persons pays \$21 a week for board. At the same rate what must a family of 8 persons pay?

$$6 : 8 = \$21 : \$x$$

$$\frac{\overset{4}{\cancel{8}} \times \overset{7}{\cancel{21}}}{\underset{\cancel{3}}{\cancel{6}}} = \$28.$$

Since we are seeking for cost, we place \$21 in the third place, because the third and fourth terms form a ratio and must be of the same kind. We know that 6 persons pay \$21, then 8 persons will pay *more* dollars. This shows us that the consequent of our second ratio will be larger than its antecedent, therefore, to have an equality of ratios we must make the consequent of our first ratio larger than its antecedent. The proportion must be $6 : 8 = \$21 : \$x$.

2. If $\frac{5}{9}$ of a store is worth \$5200, how much is $\frac{7}{8}$ of it worth?

$$\frac{5}{9} : \frac{7}{8} = \$5200 : \$x.$$

$$\frac{\$5200 \times \frac{7}{8}}{\frac{5}{9}} = \$5200 \times \frac{7}{8} \times \frac{9}{5} = \$\underline{\qquad}.$$

Arrange as indicated for cancelation. Remember the rule for dividing by a fraction.

3. If $3\frac{1}{2}$ yd. of velvet cost \$$5\frac{1}{4}$, how much will $7\frac{1}{2}$ yd. cost?

4. If $4\frac{1}{2}$ lb. of butter cost \$1.35, what will $17\frac{1}{4}$ lb. cost?

5. If $\frac{7}{8}$ of a yard of silk cost \$2.10, what will $33\frac{1}{3}$ yd. cost?

6. If $\frac{7}{9}$ of a yard cost \$$1\frac{2}{5}$, what will $\frac{3}{4}$ of a yard cost?

7. If 9 weeks' board cost \$$94\frac{1}{2}$, what will 12 weeks' board cost?

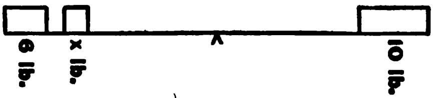
8. If a loaf of bread weighs 8 oz., when flour is worth \$5 a barrel, what should it weigh when flour is worth \$6 a barrel?

9. If 25 men can do a piece of work in 12 days, in how many days can 10 men do the same work?

10. If 24 men can build a house in 15 days, how many men will it take to build it in 24 days?

11. A tree 18 ft. high casts a shadow 45 ft. long, how high must a steeple be to cast a shadow 135 ft.?

12. If $\frac{5}{9}$ of a farm is worth \$4500, what is $\frac{3}{4}$ of it worth?



$6 \text{ lb.} + x \text{ lb.} = 10 \text{ lb.}$

1. How heavy must the x weight be that the two weights may balance the 10-lb. weight?

2. This may be written $x + 6 = 10$. When written in this form it is called an **equation**. $x + 6$ is the **first member** and 10 is the **second member**.

3. If I should take off the 6-lb. weight what would happen? What must I take off from the other side to restore the balance or equality?

4. Suppose I place a 5-lb. weight with the 10-lb. weight, what would happen? How could I restore the equality?

Learn: The same number may be added to or subtracted from both members of an equation without changing the equality.

5.
$$\begin{array}{rcr} x + 6 & = & 10 \\ 6 & = & 6 \\ \hline x & = & 4 \end{array}$$

In this equation 6 has been added to x. We must then subtract 6 from both members to find the value of x.

6.
$$\begin{array}{rcr} x - 5 & = & 12 \\ 5 & = & 5 \\ \hline x & = & 17 \end{array}$$

In this equation 5 has been subtracted from x. We must then add 5 to both members to find the value of x.

Find the value of x in the following:

7. $x - 4 = 6$ 8. $x + 6 = 14$ 9. $x - 7 = 4$
10. $5x + 2 = 12$ 11. $2x + 6 = 8$ 12. $4x + 5 = 13$
13. $3x - 7 = 11$ 14. $2x - 9 = 21$ 15. $2x - 5 = 7$

16. The difference between two numbers is 6, and their sum is 40. Find the numbers.

Let $x =$ the smaller number.
then $x + 6 =$ the larger number.
Then $2x + 6 = 40$

$$\begin{array}{rcl} 2x + 6 & = & 40 \\ 6 & = & 6 \\ \hline 2x & = & 34 \\ x & = & 17 \text{ the smaller number.} \\ x + 6 & = & 23 \text{ the larger number.} \end{array}$$

A knowledge of the equation will be found very useful in solving problems. Study the solution and see if you see where the equation, $2x + 6 - 40$, comes from.

1. $3x = 9$. Divide both members of the equation by 3.
$x = 3$.

2. $\frac{1}{2}x = 5$. Multiply both members of the equation by 2.
$x = 10$.

Learn: We may multiply or divide both members of the equation by the same number and not destroy the equality.

State what must be done to both members to find the value of x:

3. $7x = 21$
4. $3x = 18$
5. $2x = 10$
6. $\frac{1}{2}x = 4$
7. $\frac{1}{3}x = 5$
8. $\frac{1}{4}x = 6$
9. $6x = 24$
10. $9x = 45$
11. $5x = 25$
12. $\frac{1}{5}x = 6$
13. $\frac{1}{6}x = 3$
14. $\frac{1}{3}x = 2$

15. If $\frac{3}{4}$ of the number of pupils in school is 36, how many pupils are there?

Let x = the number.
Then $\frac{3}{4}x = 36$.
$3x = 144$
$x = 48$

Multiply both sides of the equation $\frac{3}{4}x = 36$ by 4. $\frac{3}{4}x \times 4 = \frac{12x}{4} = 3x$. $36 \times 4 = 144$. Then $3x = 144$.

16. $\frac{2}{5}$ of a number increased by $\frac{1}{2}$ of the number equals 27. Find the number.

Let x = the number.
Then $\frac{2x}{5} = \frac{2}{5}$ of the number.
and $\frac{1}{2}x = \frac{1}{2}$ of the number.
$\therefore \frac{2x}{5} + \frac{1}{2}x = 27$.
$4x + 5x = 270$
$9x = 270$
$x = 30$

Multiply the equation $\frac{2x}{5} + \frac{1x}{2} = 27$ by 10 (the common denominator of $\frac{2}{5}$ and $\frac{1}{2}$). $\frac{2x}{5} \times 10 = \frac{20x}{5} = 4x$. $\frac{1x}{2} \times 10 = \frac{10x}{2} = 5x$. $27 \times 10 = 270$. Hence $4x + 5x = 270$.

Each problem requires its own statement or equation. While each differs from any other, a careful study of the illustrative problems in the preceding pages should give you an idea of the method of procedure.

1. From a box containing oranges, $\frac{1}{3}$ were sold. If 82 then remained, how many were there at first?

2. Four-sevenths of a number is 18 less than the number itself. Find the number.

3. A number diminished by $\frac{5}{13}$ of itself is 7296. What is the number?

4. A horse and carriage are worth \$763. If the carriage is worth $\frac{2}{5}$ as much as the horse, what is the value of each?

5. Divide 75 apples between Richard and Henry so that Richard may have 15 apples more than Henry.

6. What number added to 3 times itself gives 64?

7. A and B together have \$450. If A has $\frac{2}{3}$ as much as B, how many dollars has each?

8. Mary and Nellie have 80 apples. Mary has $\frac{3}{5}$ as many as Nellie. How many has each?

9. An estate was divided among 3 children, so that one received $\frac{2}{7}$ of it, the second $\frac{2}{5}$ of it, and the third \$4840. Find the value of the estate.

10. A owns $\frac{2}{7}$ of a store, B $\frac{2}{9}$ of it, and C the remainder, or \$31,000. What is the value of the estate?

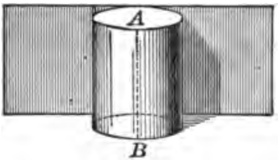
11. A owns $\frac{2}{7}$ of a store and B the remainder. If B owns \$465 more than A, what is the value of the store and of each one's share?

12. If a certain number diminished by $\frac{1}{4}$ of itself is 105, what is the number?

13. Separate \$182 in the ratio of 3 to 4.

Let $3x$ = one part.
and $4x$ = other part.
Then $7x = \$182$
$x = \$\ 26 \qquad 3x = \$78 \qquad 4x = \$104.$

14. Divide \$416 between A and B, giving A \$5 as often as you give B \$3.



1. Make a paper cylinder and cut it on the line AB, as in the figure.

2. After cutting, open to a flat surface, what form have you?

3. The length and height of the rectangle were what dimensions of the cylinder?

4. The curved surface of a cylinder is called its **convex surface**.

Learn: To find the convex surface of a cylinder, multiply its circumference by its height.

5. The ends of a cylinder have what form?

6. To find the entire surface of a cylinder, what must be added to the convex surface?

7. Repeat the rule for finding the area of a circle.

Find the entire surface of cylinders having the following dimensions, calling π $3\frac{1}{7}$.

8. Circumference 44 ft., height 20 ft.

9. Circumference 22 ft., height 42 ft.

10. Circumference 66 ft., height 30 ft.

11. Diameter 14 in., height 2 ft.

12. Diameter 21 in., height 48 in.

13. Diameter 7 ft., height 15 ft.

14. Find the convex surface of a cylinder 40 ft. long, and 15 ft. in diameter, using π as 3.1416.

15. How many square feet of surface are there in a stove pipe 16 ft. long and 7 in. in diameter?

16. At 19¢ a square yard, what will it cost to paint the outside and the inside of a cylindrical tank 9 ft. long and 7 ft. in diameter, no attention being paid to thickness of material?

17. At 5¢ a square foot find the cost of covering the rolling (convex) surface of a roller $7\frac{1}{2}$ ft. long and $3\frac{1}{2}$ ft. in diameter.

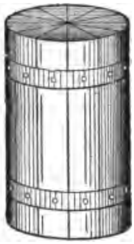


Fig. 1.

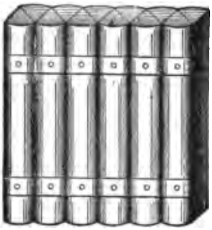


Fig. 2.

Note: — These drawings were made from a cylinder cut into sections as indicated. Fig. 2 represents a prism made by placing the sections of Fig. 1 as the parts of the circle were placed in Lesson 156.

1. How do you find the contents of a prism?

2. The length, width, and height of the prism were what dimensions of the cylinder?

3. Finding the area of one end of the prism is the same as finding the area of what in the cylinder?

Learn: To find the contents of a cylinder multiply the number of cubic units that can be placed in one layer on the base, by the number of layers. This is usually briefly stated thus: Multiply the area of the base by the height.

Using $\pi = 3.1416$, *find the volume of cylinders having the following dimensions:*

4. Altitude 8 ft. 6 in., diameter 3 ft.

5. Altitude 15 ft., radius 1 ft. 3 in.

6. Altitude 7 ft. 4 in., diameter 5 ft.

7. How many gallons approximately will a circular cistern hold that is 9 ft. deep and 3 ft. in diameter?

8. At 32¢ a cubic foot what is the value of a log 45 ft. long and 2 ft. in diameter?

9. A water pipe measures 3 ft. in diameter and 18 ft. in length. Approximately, how many gallons will it hold?

10. Find the volume of a cylinder whose circumference is 15 ft. and altitude 27 ft.

1. A can do ⅓ of a piece of work in 4 days and B can do the whole of it in 8 days. In how many days can both do it working together?

2. A horse was sold at a loss of 16⅔% and $16 was lost. Find the selling price.

3. A rectangular piece of paper containing 6 sq. ft. is 9 in. wide. How long is it?

4. A house and lot cost $9800. If the house cost 4 times as much as the lot, find the cost of each.

5. A starts from New York and travels 8 miles an hour, and 6 hours afterwards B starts from the same place and follows at the rate of 10 miles an hour. At what distance from New York will B overtake A?

6. The area of a rectangular field is 12 acres. If its length is 20 rd., what is its width?

7. In digging a trench 3 ft. wide and 4½ ft. deep, 330 cu. yd. of earth were removed. How long was the trench?

8. At $3 a cord find the cost of a pile of wood 24 ft. long, 4 ft. wide, and 7½ ft. high.

9. A button is 4.7124 in. in circumference. How long a buttonhole is needed?

10. A hogshead is 12½ ft. in circumference. Can it pass through a door 3 ft. 9 in. wide?

11. If 8¾ tons of coal cost $43¾, how many tons can be bought for $127½?

12. A farmer raised 2146 bbl. of apples. He sold ⅝ of them at $1¾ a barrel and the remainder at $2½ a barrel. How much did he receive for all?

13. How many board feet are there in 12 planks, 21 ft. long, 18 in. wide, and 2½ in. thick?

14. Find the amount of $161.60 for 2 yr. 9 mo. 3 d. at 4½%.

15. If a reservoir is 30 ft. 6 in. long and 20 ft. 6 in. wide, how many cubic feet of water must be removed to lower the water 1½ ft.?

LESSON 219 *MISCELLANEOUS PROBLEMS ON PRODUCTION*

1. The average yield of cotton per acre is 250 lb. The average weight of a bale is 500 lb. How many bales will a plantation of 600 acres produce?

2. The market quotation of cotton to-day is 12½¢ a pound. Find the value of the cotton on this plantation.

3. Should the price of cotton drop to 8¢, what per cent would the owner of this plantation lose? How much money would he lose?

4. A cotton mill in Alabama uses 15 bales a day. How many acres will it take to keep the mill running 300 days in a year?

5. How many days will the 600-acre plantation keep the Alabama mill supplied with cotton?

6. A mill in Fall River uses 115 bales a day. At 12½¢ a pound find the cost of the cotton used in this mill in 300 days.

7. It is estimated that the average consumptiom of sugar is 70 lb. for every person. Find in your geography the population of the United States and estimate the quantity consumed.

8. If the United States produces 372,000 tons annually, how much must we import?

9. At 5¢ a pound find the value of the sugar we import and the value of the quantity we produce.

10. The anthracite coal beds in Pennsylvania were estimated to contain 19,500,000,000 tons of coal. If 40% of this cannot be mined, how many tons can be mined?

11. If 3,900,000,000 tons have already been mined, what per cent of the total coal output has been taken out? How many tons still remain to mine?

12. 10,000,000,000 ft. of lumber are cut in the Southern States every year. Find the value at $16 per M.

13. In the Dakotas the farmers sowed 4,882,157 acres to wheat. The average yield was 18 bu. to an acre. Find the value of their wheat crop at 75¢ a bushel.

14. If 6 pk. of seed were sown per acre, find the cost at 80¢ a bushel of seed used on the Dakota wheat fields.

1. The selling price of a cow is $60. The gain in selling is 25%. What two things can be found? Find them.

2. A can do a piece of work in 4 days, B can do it in 5 days. In what time can A and B do it if they work together?

3. A rectangular field contains 1 acre. If it is 80 rd. long, how wide is it? What is its perimeter?

4. How many 2-in. cubes can be cut from a 10-in. cube?

5. How many cows at $25 a head can be bought for $500?

6. A man bought a gallon of milk for 28¢ and sold it at 4¢ a pint. How much did he gain on a quart?

7. What part of a dollar did I pay for 6¼ lb. of candy at 12¢ a pound?

8. I sold my watch for $18, which was 12½% more than it cost me. Find the cost.

9. What is the interest on $2468 for 30 days at 6%?

10. Divide $100 between A and B, giving A $6 as often as you give B $4.

11. If a man can walk 3¼ miles in 2 hours, how far can he walk in 8 hours?

12. If 4 men can do a piece of work in 6 days, how long will it take 12 men to do the same work?

13. What per cent of a number is $\frac{5}{8}$ of it?

14. What will 2 doz. knives cost at 33⅓¢ each?

15. An article was bought for $80 and sold at 25% profit. What two things can you find? Find them.

16. If a book agent received $50 for selling $150 worth of books, what was his rate of commission?

17. An auctioneer sold $500 worth of goods at a commission of 4%. What was his commission?

18. An article that cost $4.50 was sold for $6. What two things can you find? Find them.

19. If a boy lost $\frac{3}{5}$ of his money and had 8 cents left, how much had he at first?

1. The difference between two numbers is 2,001,005. The larger number is 89,009,089. Find the smaller number.

2. The quotient is 4769. What would the quotient be, if the dividend was multiplied by 9?

3. The quotient is 4664. What would the quotient be if the divisor was multiplied by 8?

4. The quotient is 805. What would the quotient be if the divisor was $\frac{1}{6}$ of what it is now?

5. The quotient is 909. What would the quotient be if both dividend and divisor were multiplied by 15?

6. The quotient is 478. What would the quotient be if both divisor and dividend were divided by 12?

7. If the divisor was 8 times larger than it is, the quotient would be 489. What is the quotient?

8. What number must be taken from 7684 that it may be exactly divisible by 33?

9. If 37 is added 99 times to itself the result will be how much less than 3750?

10. If 37 is added to a certain number, 85 can be subtracted from it 113 times. Find the number.

11. Of what number might 463 be both divisor and quotient?

12. If 593 is subtracted 347 times from a certain number the remainder is 287. Find the number.

13. Multiply 60.325 by 7.0034 and divide the product by 3.01625.

14. What name would you give to a figure that has 4 equal sides and 4 right angles?

15. What decimal is as much smaller than .5275 as .5275 is smaller than .74?

16. The subtrahend is 6.9 × 3.04. The minuend is 26.08 × 1.002. What is the difference?

17. Add: 243 thousandths, 203 ten-thousandths, 546 millionths, 12 and 1234 hundred-thousandths, 116 ten-millionths.

1. Find the cost of carpet 27 in. wide at $1.25 a yard for a room 18 ft. by 14 ft., if the strips run lengthwise.

2. How many board feet are there in twelve 4-in. planks 16 ft. long and 10 in. wide?

3. What will it cost to build a wall 90 ft. long, 7½ ft. high, and 2 ft. thick at $6 a cubic yard?

4. Find the number of bushels of grain in a bin that is 6′ × 5′ × 4′. 1 bu. = 1¼ cu. ft.

5. Find the number of gallons of water that can be put in a circular cistern 21 ft. in diameter and 10 ft. deep. There are 7½ gal. in a cubic foot.

6. At $4.75 a ton what is the cost of 563,800 lb. of coal?

7. How many square feet of tin will be required for making 800 rectangular cans 8″ × 6″ × 12″, adding 6 sq. in. for waste in making each can?

8. Find the interest on $1250 from Nov. 15, 1909, to March 1, 1911, at 5%.

9. A and B can build a wall in 10 days. A can build it in 18 days. How long will it take B to build it alone?

10. A pile of wood contains 200 cords. It is 4 ft. wide and 8 ft. high. How long is it?

11. If a man buys $800 worth of goods at a discount of 25%, what will be the discount? What will the goods cost the man?

12. An agent sold a farm for $7600. His commission was 2½%. Find the commission. Find the amount that the owner received for the farm.

13. An agent bought for me 8000 lb. of butter at 30¢ a pound. If his commission is 3%, how much money must I send him?

14. A grocer bought 160 barrels of potatoes @ $1.60 a barrel. 10% of them spoiled and he sold the remainder at $1.90 a barrel. How much did he gain?

15. If an acre of ground costs $240, what is the value of a rectangular lot 12 rd. long and 165 ft. wide?

1. Land which cost $5600 was sold at a profit of 25%.

2. 17 gal. 3 qt. 1 pt. of molasses were sold from a cask containing 25 gal. 2 qt.

3. In a school the girls are 52% of the whole number, and there are 240 boys.

4. A granite step measures $\frac{2}{3}' \times 2' \times 8'$. A cubic foot of granite weighs 170 lb.

5. The circumference of the driving wheel of a locomotive is 22 ft. In going from A to B the wheel turned 9600 times.

6. A farmer raised 45 acres of oats, averaging 25 bu. to an acre. The price of oats was 52¢ a bushel.

7. A cistern of water was $\frac{4}{5}$ full. $\frac{1}{2}$ of the contents of the cistern was drawn off at one time and $\frac{1}{3}$ of the remainder at another time.

8. A man bought a house for $2160. The house cost him $\frac{3}{5}$ as much as he paid for a mill.

9. A steamboat runs 144 knots in 6 hours. It takes 36 hours for the steamboat to run a certain distance.

10. It is 137 miles from Portland to Bangor. A man walks about 3.5 miles an hour.

11. A bicycle tire is 28 in. in diameter. A boy rode $\frac{1}{2}$ mile.

12. A clerk earned $15 a week for 14 calendar months.

13. A man owned 16 A. of land. He sold 1280 square rods.

14. A grocer paid $3.78 for a barrel of vinegar ($31\frac{1}{2}$ gal.) and sold it at 5¢ a quart.

15. On March 1, 1909, the sun rose at 6 hr. 36 min. A.M., and set 5 hr. 50 min P.M. On July 1, it rose at 26 min. past 4 o'clock and set at 40 min. past 7 o'clock.

16. A man borrowed $250 at 5%. He returned it in 2 yr. 4 mo. 20 d.

17. The living expenses of a family are $65 a month.

18. A bin, 12 ft. long, 4 ft. wide, and 3 ft. deep, is full of potatoes, worth 65¢ a bushel.

Review Pages 1 to 11.

1. What is a unit?

2. What is notation?

3. Why is our system of notation called the Arabic system? Why is it called a decimal system?

4. What is numeration?

5. What do you mean by the *place value* of a figure?

6. Name the first five periods. Name in order the first six decimal places.

7. Read 3,010,004,300.03.

8. Write in figures, forty-six billion, seventy million, six thousand six and one thousand two hundred five millionths.

9. Name the result of an example in addition.

10. Show by example when the result of subtraction should be called a difference, and when it should be called a remainder.

11. What is a concrete number? Give an illustration.

12. Name the terms used in multiplication.

13. When the multiplicand is an abstract number, what will the product be?

14. Give two definitions for division. Illustrate each definition by an example.

15. Name the terms used in division, and give an example illustrating the use of each.

16. What is the effect on the quotient of multiplying the divisor by 2?

17. In what other way may the same effect be produced?

18. Show that multiplication is a short process of addition.

19. How do you check the work in multiplication?

20. Divide 432,089,052 by 475,869.

21. Multiply 487,653,879 by 5,086,009.

22. From 7,009,560,001 take 1,974,685,745.

23. Add 7086; 9; 170,094; 32; 5; 702; 4,005,019; 12; 807.

Review Lessons 125 to 129.

1. What is a factor?

2. What are the factors of 12? 18? 24?

3. What is factoring?

4. What is a prime number? Give an illustration.

5. What is a composite number? Give an illustration.

6. Find the prime factors of 3645. Of 9768.

7. Name a multiple of 7. Name a multiple of 7 that is also a multiple of 3.

8. What do you mean by the least common multiple?

9. Find the least common multiple of 45, 63, 72, 99.

10. Name a divisor of 14. Name a divisor of 49 that is also a divisor of 14.

11. What do you mean by greatest common divisor of two or more numbers?

12. Find the greatest common measure (divisor) of 36, 84, 132.

13. What is cancelation? Where should you use it in your work?

14. How many times as much will a box contain whose dimensions are 11″ × 27″ × 30″, as one whose dimensions are 6″ × 9″ × 15″?

15. Of what advantage is cancelation in example 14? On what principle is it based?

16. What is a fraction?

17. Name the terms of a fraction and tell what each term indicates.

18. Define a proper and an improper fraction and give an illustration of each.

19. What is meant by reduction of fractions? On what principle is it based?

20. Reduce $\frac{4}{15}$ to 60ths. $\frac{36}{144}$ to lowest terms. $12\frac{11}{24}$ to an improper fraction. $\frac{578}{72}$ to a mixed number.

Review Lessons 130 to 135.

1. What are similar fractions?

2. To what must we change $\frac{2}{3}$ and $\frac{3}{5}$ before we can add or subtract them?

3. Add $52\frac{2}{3}$ and $61\frac{1}{8}$. Subtract $39\frac{1}{3}$ and $24\frac{7}{12}$.

4. A man had a farm of $125\frac{1}{4}$ acres. He planted $3\frac{3}{8}$ acres with potatoes, $4\frac{1}{2}$ acres with corn, and $9\frac{3}{4}$ acres with oats. If the rest of the farm was equally divided between pasture and mowing, how many acres of mowing were there?

5. State the two ways for multiplying a fraction by an integer.

6. Which method would you use in multiplying $\frac{8}{9}$ by 3? In multiplying $\frac{5}{7}$ by 2?

7. How do you multiply a fraction by a fraction?

8. Multiply $4\frac{2}{9}$ by $27\frac{1}{8}$.

9. Find the cost of $345\frac{3}{8}$ M. of pine flooring @ $\$32\frac{3}{4}$.

10. State the two ways of dividing a fraction by an integer.

11. Which method would you use in dividing $\frac{14}{15}$ by 7? In dividing $\frac{3}{5}$ by 2?

12. How do you divide an integer by a fraction?

13. Divide $142\frac{1}{2}$ by 5. Divide 8 by $3\frac{4}{5}$.

14. Divide $\frac{3}{4}$ by $\frac{5}{2}$. What change do you make in these fractions before dividing?

15. A field contains $1079\frac{7}{8}$ sq. rd. One side is $40\frac{3}{4}$ rd. long. The other side is —— rd.

16. State the rule for dividing a fraction by a fraction without changing them to similar fractions.

17. Express $3 \div 4$ as a fraction.

18. Express $\frac{2}{3} \div \frac{3}{4}$ as a fraction.

19. What is a complex fraction? How may it be changed to a simple fraction?

20. What change is made in the value of a fraction by dividing the numerator by 3?

Review Lessons 140 to 144.

1. Name the first eight decimal places.

2. Read .0001005.

3. Multiply 5.005 by 1000. How did you do it?

4. How would you divide 15.02 by 100?

5. What decimal place is occupied by hundredths? By ten-thousandths? By millionths?

6. A unit consists of how many tenths? Of how many thousandths?

7. A cent consists of how many tenths? A tenth of a cent is called what?

8. How should decimals be arranged for convenience in adding and subtracting?

9. If a man has 101.8 acres of land and buys 51.75 acres more, how many acres will he then have?

10. If this man then sells 25.25 acres, how many acres will he then have?

11. Give the rule for multiplying a decimal by a decimal.

12. How does the number of decimal places in the product compare with the number in the multiplicand and multiplier?

13. When dividing a decimal by a decimal what change is first made in the position of the decimal points?

14. How does the number of decimal places in the quotient compare with the number in the divisor and dividend?

15. How do you change a decimal fraction to a common fraction?

16. Change .0375 to a common fraction in its lowest terms.

17. How do you change a common fraction to a decimal?

18. Change $5\frac{4}{75}$ to a mixed decimal.

19. What will 4280 ft. of boards cost at $21.75 per M?

20. At 15¢ per C, what is the freight on 7875 lb. of plaster?

21. Find the cost of 7486 lb. of coal at $5.65 a ton.

22. Find the cost of 8798 ft. of timber at $14.70 per M.

Review Lessons 145 to 147.

1. What does 6% mean?

2. Write 12½ per cent using the sign of percentage. Write it as a decimal fraction and as a common fraction.

3. What is percentage?

4. Name the three cases in percentage. Make examples illustrating each case.

5. A farmer takes 420 lb. of milk to a creamery and is paid 21¢ a pound for the butter fat. If the butter fat is 3.6% of the weight of the milk, how much does he receive?

6. A house worth $7200 is insured for ¾ of its value. If the rate for insuring is 60¢ on $100, what sum must be paid?

7. Change ¼% to a decimal. Change .005 to a per cent.

8. 75 is 15 per cent of what number?

9. If the ore is 35% pure, how much iron will 6893 lb. of ore produce?

10. Given the cost of an article and the rate of gain. What can you find? Illustrate by an example.

11. Given the selling price and the loss per cent. What can you find? Illustrate by an example.

12. A man paid an agent $65 for collecting a bill. If he paid the agent 2½% of all he collected, what did the agent collect?

13. A livery man bought two horses at $125 each. In selling he lost 20% on the first and gained 25% on the second. How much did he gain in all?

14. A owns 45% of a factory worth $48,000, B owns 36½% of it, and C owns the remainder. What is the value of each of their shares?

15. What sum of money less 7% of itself is $483.60?

16. There are 20,880 pupils in school. If this is 36% of the entire population, what is the population?

17. A commission merchant sold 540 bbl. of flour at $6.37½ a barrel. Find his commission at 3%.

Review Lessons 76, 77, 148, 149, 150.

1. In every bill who is the creditor? Who is the debtor?

2. What should each item of a bill give?

3. What do you mean by the footing of a bill?

4. Mr. Covert bought of the Cash Grocery Store, Aug. 2, 4 lb. 8 oz. of steak @ 22¢; 2 lb. 9 oz. lamb chops @ 16¢. Aug. 4, 1 lb. 4 oz. sausages at 20¢; 4 lb. 9 oz. beef @ 24¢. Aug. 6, 8¼ lb. turkey @ 20¢. Make out the bill and receipt it.

5. As clerk for the Cash Grocery Store, write for Mr. Covert a receipt in full.

6. Rule paper and write the following as a cash account: Mr. Crowell bought a 200-acre wood lot at $12 an acre. He paid 36 men $1.50 a day for 24 days' work at cutting. He sold 260 cords @ $3.25, and 480 cords @ $3.75. He then sold the lot for $900.

7. Make out a pay roll when the hours a day and wages an hour are as follows: A, 8, 9, 9, 8, 9, 8½, 26¢; B, 9, 8, 9, 9, 9, 8¾, 32¢. C, 7, 8, 8, 0, 6, 8, 30¢. D, 8, 8, 8½, 7¾, 8, 8, 36¢.

8. Give the rule for finding the area of a rectangle.

9. How many square rods are there in a rectangular field 36 rd. long and 24 rd. wide?

10. How do you find one dimension of a rectangle when you know the other dimension and the area?

11. The area of a rectangular field is 20 acres. If its width is 40 rd., what is its length?

12. How do you find the volume of rectangular solids?

13. Find the contents of a rectangular prism 20′ × 14′ × 10′.

14. What measures would you need to know to find the square feet in the walls and ceiling of this room?

15. Take the measurements and find the square feet of surface in the six sides of the room.

16. What will it cost at 1⅞¢ a square inch to polish the sides and top of a granite shaft 6 ft. high, if the width is 2 ft. and the thickness 22 in.?

Review Lessons 151 to 156.

1. What is an angle?

2. How many degrees are there in a right angle?

3. When will the hands of the clock form an angle of 60°?

4. What is a triangle? How many sides and angles has it?

5. How do you find its area?

6. A field is in the form of a triangle. Its base is 120 rd. and its altitude 40 rd. It contains —— acres.

7. The area of a triangle is 7 sq. yd., and the altitude is 21 ft. What is the base?

8. Each side of an octagonal (8-sided) pyramid is a triangle. Its base is 12 ft., and its altitude is 75 ft. How many square feet are there in all the sides? Find the cost of painting it at 20¢ a square yard.

9. A barn is 90 ft. long, 45 ft. wide, and 30 ft. high to the eaves. The height of the gable is 15 ft., and the rafters are 30 ft. long. Using a scale of 1 in. to 15 ft., make a drawing to represent the barn as on page 48.

10. Find the number of feet of boards needed to cover the roof and sides.

11. Find the number of feet of lumber needed for the floor covered with 2-in. plank.

12. What is the ratio of the circumference of a circle to its diameter? How is it represented?

13. What dimensions of a circle do you need to know in order to find its area? How do you find the area?

14. Draw a circle with a radius of 5 in., to represent a lot of land. If the scale is $\frac{1}{4}$ in. to a rod, how many square rods are there in the field? How many acres?

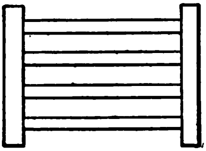
15. A wheel whose diameter is 3 ft. turns how many times in going a half-mile?

16. It is 75 ft. in a straight line from where I am standing across a circular pond. How far must I walk to reach the point directly opposite?

Review Lessons 157 to 160.

1. Find the cost at $30 per M for 20 joists, each 18 ft. long, 5 in. wide, and 3 in. thick.

2. A rectangular field is 36 rd. long and 162 ft. wide. If posts are placed 9 ft. apart, how many will it take? Find their cost at $35 per C.



3. This represents one panel of the fence round this field. If the boards are 6 in. wide, find the cost of lumber for the fence at $15 per M.

4. What is the value of a pile of wood 40′ × 4′ × 5½′ at $5.50 a cord?

5. A bin will hold 448 bu. of apples, how many cubic feet does it contain? If the bin is 10 ft. long and 7 ft. wide, how deep is it?

6. If a cubic foot of coal weighs 90 lb., how many cubic feet must a bin contain to hold 15 tons? If the bin is 10 ft. long and 4 ft. wide, how deep is it?

7. If a tank is 4 ft. long and 3 ft. wide, how deep is the water in it if it contains 200 gallons?

8. How do you find the number of breadths of carpet needed for any room?

9. How many yards of carpet 27 in. wide will be needed for 3 rooms measuring 22′ × 15′, 18′ × 15′, 10½′ × 9′?

10. At $2.25 a yard find the cost of carpet 27 in. wide for a room 26′ × 11′ 3″.

11. At $1.25 a yard find the cost of carpet ¾ yd. wide to cover a floor 27 ft. long, 16 ft. wide. The breadths run lengthwise, and there is a loss of 3 in. on each breadth for matching.

12. I wish to carpet a room 20 ft. by 18 ft. with carpeting 2¼ ft. wide. How much shall I save by laying the carpet crosswise instead of lengthwise, if the carpet costs $1.90 a yard?

13. How much will it cost at 36¢ a square yard to plaster the walls and ceiling of a room 18′ × 14′ × 9′, deducting 180 square ft. for openings?

Review Lessons 164, 165, 213, 214, 215.

1. A farmer picked 3 times as many russets as greenings and as many baldwins as russets and greenings. In all he picked 96 barrels of apples. How many of each kind did he pick?

2. A bookseller sold a number of books one day, 4 times as many the next day, and on the third day 2 times as many as on the first day. In all he sold 252 books. How many did he sell each day?

3. Divide 64 into two parts, so that one part shall be 3 times the other part.

4. Two numbers are to each other as 3 to 5, and their sum is 128. Find the numbers.

Find the value of x:

5. $6x + 6 = 24$

6. $3x - 6 = 10$

7. $3x + 3 = 12$

8. $4x - 7 = 9$

9. $5x + 5 = 15$

10. $4x - 3 = 17$

11. Seven times a number increased by 3 times the number is 50. Find the number.

12. Eight times a number, divided by 2, is 16. What is the number?

13. One eighth of the sum of a certain number and 18 is 34. What is the number?

14. A certain number increased by 5 equals 11. What is the number?

15. A newsboy sold a certain number of papers on Monday, and 10 more on Tuesday than on Monday. In all he sold 42 papers. How many did he sell each day?

16. Charles has 64 cents, which lacks 16 of being 5 times as many as Arthur has. How many cents has Arthur?

17. A line 45 inches long was divided into 2 parts, one of which was 12 inches longer than the other. How long is each part?

Review Lessons 166, to 177.

1. What is interest? Principal? Amount?

2. Find the interest on $1000 for 3 yr. at 5%.

3. Write a promissory note, making yourself the maker, and your teacher the payee.

4. How do you find the interest at 6% on any sum of money for 2 mo. or 60 d.?

5. When you know the interest for 2 mo., how would you find the interest for 10 mo.? 1 yr. 4 mo.?

6. When you know the interest for 60 d., how would you find the interest for 30 d.? 15 d.? 20 d.?

7. Find the interest on $625.80 from Nov. 28, 1909, to Sept. 16, 1911, at 6%.

Find the interest on:

8. $4,763.25 for 1 yr. 9 mo. 13 d. at 7%.

9. $485.16 from Aug. 3, 1909, to Nov. 17, 1910, at 5%.

10. $864 from Mar. 10, 1909, to Aug 30, 1911, at 4%.

11. $1700 for 28 days at 8%.

Find the amount of:

12. $2679.13 from June 6, 1910, to July 6, 1912, at 7%.

13. $4163.17 from April 11, 1909, to July 1, 1911, at 6%.

14. $162.50 from Aug. 16, 1910, to Nov. 29, 1911, at 4%.

15. I borrowed $500 from a friend, promising to pay 6 cents a year for every dollar I borrowed. If I kept his money 3 yr. 3 mo., how much must I pay for the use of it?

16. I borrowed $350 at 6% interest, Oct. 10, 1909. How much shall I owe Jan. 1, 1912?

17. A farmer sold 19½ tons of straw at $15½ a ton, and took a note at 6% in payment. Write the note. If the note was paid in 90 days, how much did he receive?

18. May 1, 1909, I borrowed $364, and Feb. 7, 1911, I paid it back with interest at 6%. How much did I pay?

Review Lessons 178 to 183.

1. A merchant sold goods which cost him $4,768.75 at a profit of 18%.

2. A man raised 1640 bu. of grain and sold 246 bu.

3. A grocer bought $400 worth of oranges, 25% spoiled before he sold them. The remainder he sold at 16⅔% above cost.

4. A farm which cost $3400 was sold at a gain of 22%.

5. $1500 was on interest 1 yr. 3 mo. 27 d. at 6%.

6. A man bought 120 acres of land at $60 an acre and paid 25% of the cost of the land for buildings. The next year he sold at a gain of $2000.

7. Some 4 ft. wood is piled 6 ft. high. The pile contains 24 cords.

8. A man built a house costing $3500 on a lot which cost $600. The house burned and the insurance company paid him 80% of the cost of the house. Then he sold the land at an advance of 80%.

9. An article that cost $75 was sold for $95.

10. If 12 men build a wall in 8 days, how long will it take 16 men?

11. Find the entire surface of a rectangular column whose altitude is 12 ft. and base 18 in. by 14 in.

12. At $1.40 a yard find the cost of carpeting a room 21 ft. by 16 ft. with carpet ¾ yd. wide. The breadths run crosswise and there is a loss on each breadth of 1 ft. for matching.

13. A rectangular lawn measures 15 yd. 2 ft. in length and 33 ft. 8 in. in width. At 75¢ a square foot find the cost of sodding the lawn.

14. Find the number of square feet in a walk 3 ft. 8 in. wide running round the outside of the lawn in example 13.

15. Find the cost of 1860 ft. of lumber at $24.50 per M.

16. If I pay $4⅖ for 5½ lb. of tea, what must I pay for 9⅞ lb. at the same rate?

Review Lessons 184 to 186.

1. What are compound denominate numbers?

2. What do you mean by reduction of compound numbers?

3. Write the table of Liquid Measure.

4. How many gallons of water will fill a cubic foot?

5. Write the table of Dry Measure.

6. How many cubic feet are there in an even bushel? In a heaped bushel?

7. When is the even bushel used? The heaped bushel?

8. Write the table of Long Measure.

9. Give the length of a fathom, a knot, a league. Where are these measures used?

10. Write the table for Square Measure.

11. In many unsettled parts of the country the land is divided into sections instead of townships. How many acres are there in each section?

12. Write the table of Cubic Measure.

13. How many bricks are estimated as equal to one cubic foot?

14. How many bricks are there in a wall 18 ft. long, 9 ft. high, and 18 in. thick?

15. What are the dimensions of a brick?

16. How many bricks will it take to cover a sidewalk 12 ft. by 3 ft.?

17. Write the table of Avoirdupois Weight.

18. How many pounds are there in a long ton?
Where is the long ton used?

19. A dealer bought 425,600 lb. of coal at $2.75 a long ton and paid $.85 a ton for freight. He sold it at $5.50 a short ton and paid $.25 a ton for delivery. How much did he make?

20. Write the table for Time Measure.

21. Write the table for United States Money.

Review Lessons 187 to 195.

1. Write the tables for counting.

Change:

2. 17 yards to inches.
3. 7.8 mi. to feet.
4. 2.25 mi. to rods.
5. 960 rods to higher units.
6. 720 in. to yards.
7. 750 ft. to yards and feet.
8. 35 sq. yd. to square inches.
9. 23,958 sq. ft. to sq. rd.
10. 42 cu. yd. to cu. ft.
11. 6912 cu. in. to cu. ft.
12. 3 T. 700 lb. to pounds.
13. 64,000 oz. to tons.
14. 396 gi. to quarts.
15. 76 gal. to pints.
16. 16 d. to hours.
17. 252 hr. to days.
18. 19 hr. 18 min. 15 sec. to seconds.

19. How many acres are there in 609,840 sq. ft.?

20. A box of butter weighed 15 lb. 10 oz. If the box weighed 3 lb. 2 oz., find the value of the butter at 30¢ per pound.

21. If a rail is $16\frac{1}{2}$ ft. long, how many rails will it take to lay a railroad track 2 mi. 100 rd. long.?

22. A farmer had 750 bu. 1 pk. of potatoes and put them into barrels, each barrel holding 2 bu. 1 pk. How many barrels did it take?

23. Divide 19 lb. 2 oz. by 3.

24. What part of 2 gal. is 2 qt. 1 pt.?

25. From 24 mi. take 17 mi. 88 rd.?

26. Multiply 10 cd. 13 cu. ft. by 12.

27. If a car runs 18 mi. 140 rd. in $\frac{1}{2}$ hr., how far will it run in 12 hours?

28. What is the area of a rectangular field 8 rd. 10 ft. long and 6 rd. 8 ft. wide?

29. Divide 17 hr. 32 min. by 4.

30. Change $\frac{7}{8}$ of a ton to pounds.

31. What will $\frac{1}{2}$ mile of fence cost at $1.50 a rod?

Review Lessons 202, 203, 216, 217.

1. What is the square of a number?

2. Write the squares of all the numbers from 1 to 12.

3. $(17)^2 =$ ——. In this example what is the figure 2 called? What does it tell us?

4. $(49)^2 =$ ——. **5.** $(87)^2 =$ ——.

6. Find the square of 1001.

7. Find one of the two equal factors of 81.

8. Finding one of the two equal factors of a number is called finding the —— —— of the number.

9. A square measures 25 rd. on a side. It contains —— sq. rd.

10. At $50 an acre find the cost of a square field measuring 40 rd. on a side.

11. A farmer has a lot 40 rd. long, 20 rd. wide. What is 35% of it worth at $80 an acre?

12. How many pickets 3 in. wide and nailed 3 in. apart will it take to fence a lot 4 rd. long and 10 rd. wide?

13. A well is 22 ft. deep and 5 ft. in diameter. How many cubic feet of water are there in it if it is $\frac{2}{3}$ full?

14. What is the difference in volume between a square prism 7 in. wide and 25 in. long and the largest cylinder that can be cut from the prism?

15. Comparing the area of the base of the cylinder with that of the prism, we find it to be a little more than $\frac{3}{4}$ of it. What then must be true of the volume of the cylinder compared with that of the prism?

16. If every cylinder is about $\frac{3}{4}$ the volume of a prism having the same dimensions, find approximately the volume of a cylinder whose diameter is 9 in. and altitude 20 in.

17. Find approximately the volume of a cylinder whose diameter is 21 in. and altitude 42 in.

18. A cylinder is 3 ft. 8 in. long and has a diameter of $1\frac{1}{2}$ ft. How many gallons will it hold?

Review Lessons 208 to 212.

1. What is ratio?

2. Express the ratio of 9 to 3 in three ways.

3. How do you find the ratio between two numbers?

4. Name the terms of a ratio.

5. A and B together have $84. If A's money is to B's as 4 to 3, how much money has each? Solve this problem by ratio, then solve it by algebra.

6. What is proportion?

7. Write a correct proportion.

8. $6 : 3 = 8 : 2$. Is this a correct proportion?
Prove your answer in two ways.

9. What are the terms of a proportion? What must be true of the terms?

10. The antecedent of the second ratio is what term of the proportion?

11. Write four proportions having a different term missing in each. Find the missing terms.

12. If 35 acres of land cost $927.50, what will 175 acres cost? Is this a direct or inverse proportion?

13. If 9 men can build a wall in 15 days, how long will it take 5 men to build it? Is this a direct or inverse proportion?

14. If it requires 42 yd. of carpeting $\frac{3}{4}$ yd. wide to cover a floor, how many yards $\frac{7}{8}$ yards wide will cover the same floor?

15. If a train travels 220 mi. in 8 hr., how long will it be in traveling 330 miles?

16. If $2\frac{3}{4}$ yd. of cloth can be bought for $3.30, what will $15\frac{7}{8}$ yd. cost?

17. What will $94\frac{1}{5}$ yd. of cloth cost, if $165\frac{1}{3}$ yd. cost $74.40?

18. If $\frac{7}{8}$ of a pound of tea cost 63 cents, what will $132\frac{1}{2}$ lb. cost?

19. If $2.80 will buy $\frac{7}{8}$ of a ton of coal, how much coal can be bought for $1.60?

1. Four men cut a pile of wood. If the first man cut $\frac{1}{4}$ of it, the second $\frac{1}{3}$, and the third $\frac{3}{8}$, how much did the fourth cut?

2. If $1\frac{1}{4}$ lb. of beef and $1\frac{3}{8}$ lb. of flour are allowed to each man as a ration, how much will rations for 618 men cost if beef is 15¢ a pound and flour $3\frac{1}{2}$¢ a pound?

3. If $\frac{3}{4}$ of a farm is valued at $2,253.30, what is the value of $\frac{2}{3}$ of it?

4. If an angle measures 45°, what part of a right angle is it?

5. A man bought 6 boards, each 16 ft. long and $1\frac{1}{2}$ in. thick. Their widths were as follows: 8 in., 9 in., 10 in., 12 in., 13 in., 14 in. How many feet of lumber did he buy?

6. Find the entire surface of a 9-in. cube.

7. A boy gave his brother Charles $\frac{2}{7}$ of his marbles and to Henry $\frac{3}{5}$ of the remainder. Henry received 7 more than Charles. How many did each receive?

8. Write the following as per cents, using the sign: .08, .025, 1.05, $.00\frac{1}{2}$, $.06\frac{1}{4}$, $\frac{3}{10}$, $\frac{7}{12}$, 3.75, .0045, 4.5.

9. Add the product of 7.1 and 7 ten-thousandths to 9 hundredths.

10. Find the interest on $575 from Sept. 14, 1911, to March 2, 1913, at 4%.

11. A grocer bought 40 doz. cans of corn listed at $1.10 a dozen. He was allowed a discount of 20%. What was the net price? The *net price* is the cost after the discount has been deducted.

12. At $7.50 a thousand, what will the bricks cost for a wall 80 ft. long, 6 ft. high, and 1 ft. thick?

13. Find the weight of a block of marble 3′ 8″ long, 2′ wide, and 1′ 3″ thick, if its specific gravity is 2.7. This means it is 2.7 times heavier than water, and a cubic foot of water weighs $62\frac{1}{2}$ lbs.

14. Find the number of yards of carpet 27 in. wide needed for a room 17 ft. 8 in. long and 15 ft. 4 in. wide.

1. The end of a building measures 27 ft. in width and 18 ft. to the eaves. The height of the gable is 9 ft. Using a scale of ½″ to 9 ft., make a drawing to represent the end of the building.

2. If the wind exerts a pressure of 9 lb. 8 oz. upon each square foot of surface, what is the total wind pressure against the end of the building?

3. This building is 36 ft. long and the rafters are 16 ft. long. Find the weight of snow on the entire roof, if the weight on each square foot of surface is 18 pounds.

4. Write the following data as a cash account:

Mar. 10, Paid for 5 d. labor @ $1.25; 100 bu. seed oats @ 38¢; 6½ d. work ploughing @ $1.25. Aug. 15, Paid for cutting 40 acres of oats @ 75¢; Sept. 5, Threshing 1864 bu. oats @ 3¢; 4 d. help in threshing @ $1.50. Dec. 10, Received pay for 1650 bu. oats @ 28½¢; 74 loads straw @ $5.50.

5. A lawn tennis court, 78′ × 36′, has on each side a strip of sod 9′ wide and on each end a strip 18′ wide. What will the sod cost at 27¢ a square yard? Make a diagram to illustrate.

6. An automobile running 36 mi. an hour meets another running in the opposite direction 24 mi. an hour. At what rate do the two automobiles approach each other?

7. If the automobiles in example 6 are 10 miles apart at 9 A.M., when will they pass each other?

8. Answer questions 6 and 7 for two automobiles running at the given speed in the same direction.

9. Two numbers are to each other as 2 to 7. If their difference is 65, find the numbers.

10. The sum of a number and half of the number is 60. What is the number?

11. The radius of a circle is 7 in. The width of a rectangle of equal area is 7 in. What is its length?

12. The sum of two numbers is 42 and their difference is 6. Find the numbers.

1. Nellie has 45 cents and Grace has $\frac{5}{9}$ as many. How many cents has Grace? How many have both?

2. If $\frac{1}{3}$ of a barrel of sugar costs $3, what will $2\frac{2}{3}$ barrels cost?

3. Find the interest on $500 from Jan. 1, 1910, to July 1, 1911, at 6%.

4. How many square yards are there in a floor that is 12 ft. square?

5. If an article that costs $600 is sold at a gain of 1%, what is the gain? What would be the gain at $\frac{1}{3}$ of 1%?

6. $\frac{1}{8}$ of 40 is what per cent of $\frac{1}{2}$ of 20?

7. When is the selling price more than the cost?
When is it less?

8. Find the change due from 3 dimes for a 27¢ purchase.

9. What number added to twice itself gives 18?

10. In a pile of wood there are 24 cords. If $\frac{3}{8}$ of the pile is worth $54, what is 1 cd. worth?

11. 54 is how many times $\frac{3}{8}$ of 24?

12. How many cubic feet are there in a wall 30 ft. long, 4 ft. high, and 2 ft. thick?

13. How many one-foot cubes can be placed in a cubical box, one yard long, one yard wide, and one yard high?

14. Divide 30 d. 15 hr. 45 min. by 3.

15. What name can you give to any figure having four sides?

16. A pile of oats weighs 96 lb. How many bushels are there?

17. A fishpole is 12 ft. long. If it was 3 ft. longer, it would be $\frac{5}{8}$ as long as the line. How long is the line? How long are both line and pole?

18. If school begins at 1.45 P.M. and closes at 3.30 P.M., how many minutes are there in the afternoon session?

19. A man had $180, and gave $\frac{2}{9}$ of it away. If he spent $\frac{3}{7}$ of the remainder, how much had he left?

1. Multiply .8 by .96. Divide 2.048 by .00512.

2. Find the least common multiple of 28, 32, 56, 76, and 96.

Find results :

3. $16 \div \frac{7}{15}$ of $2\frac{8}{11}$ of $\frac{11}{35}$. **4.** $8\frac{3}{5} \div 6\frac{1}{7}$.

5. $23\frac{5}{8} + 32\frac{9}{8} + 18\frac{3}{4} + 27\frac{5}{6}$. **6.** $64\frac{3}{4} - 28\frac{13}{16}$.

7. If 6 acres of land cost $72, what will $\frac{2}{16}$ of 80 acres cost?

8. If $\frac{1}{8}$ of a certain number is 16 more than $\frac{1}{9}$ of it, what is the number?

9. What will it cost at 54¢ a cubic yard to dig a ditch 2 ft. deep and $1\frac{1}{2}$ ft. wide round a lot 4 rd. long and $3\frac{1}{3}$ rd. wide?

10. If a stick of timber 20′ × 12″ × 10″ is sawed into boards 1 in. thick, how many board feet will there be?

11. Write in words the denominator of a decimal of 4 figures. One of seven figures.

12. What will a merchant receive for 7400 yd. of cloth at $7\frac{1}{2}$ ct. a yard, if he deducts 15% from the bill?

13. What is the value of 12 pairs of shoes at $3.25 a pair, less a discount of 5%?

14. How many cords of wood will a log make that is 3 ft. in diameter and 40 ft. long?

15. The area of a rectangle is 60 sq. yd. If its base is 120 ft., what is its altitude?

16. What is the cost of a pile of wood 27 ft. 6 in. long, 4 ft. wide, 11 ft. 3 in. high, at $\$5\frac{1}{4}$ a cord?

17. A horse and carriage cost $660. The horse cost 5 times as much as the carriage. Find the cost of each.

18. An agent's salary was increased 30%. If he then received $2600, what did he receive before the increase?

19. A man lost $\frac{2}{5}$ of his money and had $411 remaining. How much had he at first?

20. A boy began to work at 9 A.M. In 10 min. he had done $\frac{1}{15}$ of his work. When did he finish?

1. If 5 yd. of cloth are worth 80 cents, how much is $\frac{5}{8}$ of a yard worth?

2. If 4 men can do a piece of work in 6 days, how long will it take 12 men to do the same work?

3. $\frac{3}{5}$ of 80 is what per cent of $\frac{1}{2}$ of 120?

4. If $\frac{3}{4}$ of a ton of coal is worth \$$3\frac{3}{4}$, how much are $3\frac{1}{2}$ tons worth?

5. From what number may 8 be taken 3 times and leave 3 as a remainder?

6. A rectangular field contains 1 acre. If it is 40 rd. wide, what is its perimeter?

7. How must a merchant mark cloth that cost 12¢ a yard so as to gain 25%?

8. What per cent of an acre is a rectangular lot 4 rd. by 5 rd.?

9. A gain of \$5 on goods that sold for \$25 is a gain of what per cent?

10. How much will a 40 qt. can of milk cost @ 24¢ a gallon?

11. A river is 60 ft. deep. How many fathoms deep is it?

12. How far must a man travel in a day, to travel 133 miles in a full week?

13. A watch cost \$40 and a chain cost \$12. What per cent of the cost of the watch is the cost of the chain?

14. Find the cost of 1000 cd. of wood at \$$5.12\frac{1}{2}$ a cord.

15. A man earned \$100 a month. If he spent \$4 out of every \$10, how much could he save in a year?

16. What will 27 lb. of coffee cost at $33\frac{1}{3}$¢ a pound?

17. Add all the prime numbers between 1 and 10.

18. How many hours is it from 2.45 P.M. to 5.15 P.M.?

Name two factors of each of the following numbers:

19. 45 48 49 50 54 55 56

20. 81 88 96 108 121 132 144

1. If you buy oranges at 15¢ a dozen and sell them at 2 for 5 cents, what will be your gain per cent?

2. If a man buys a horse for $300 and sells it for $360, what per cent will he gain?

3. A boy bought some marbles for 12 cents and sold them for 15 cents. Find his gain per cent.

4. A merchant bought some muslin at 10¢ a yard and sold it at a gain of 20%. Find his gain on 25 yards.

5. A farmer had 50 sheep and bought 20% more. He then had — sheep.

6. A man spent 16⅔% of his month's salary. If he spent $15, what was his month's salary?

What is the interest at 6% *on:*

7. $200 for 2 yr.

8. $300 for 4 yr.

9. 500 for 60 days.

10. 600 for 90 days.

11. 400 for 1 yr. 2 mo.

12. 800 for 1 yr. 4 mo.

13. 1000 for 2 yr. 6 mo.

14. 1500 for 8 mo. 6 days.

15. What is the loss per cent on goods costing 15¢ a yard if sold at 12¢ a yard?

16. What per cent of a score is a dozen?

17. What per cent of an acre is a lot 16 rd. by 5 rd.?

18. A boy earned 20¢. This was 20% of what he had before. How much had he before? How much has he now?

19. If a merchant buys goods for $5, at what price must he sell them to gain 25%?

20. An article that cost $40 was sold for $50. What was the gain per cent?

21. A man gained 12½% by selling an article for $8 more than it cost him. Find the cost.

22. Can you lose more than 100% in selling an article?

23. Can a gain be greater than 100%? If so, make an example to illustrate.

1. A house which cost $1200 was sold at a gain of 25%. What was the selling price?

2. Land which cost $42 an acre was sold at a gain of 8⅓%. Find the selling price.

3. A fruit dealer bought apples at $1.75 a barrel, and sold them at $2.25 a barrel. What per cent did he gain?

4. A furniture dealer sold for $2.76 a chair that cost him $2.40. What per cent did he gain?

5. What is the net amount of a bill for $2478 after a reduction of 5% has been made?

6. What is the cost of insuring 640 bbl. of flour, worth $4 a barrel, if the cost of insurance is ½% of the value of the flour?

7. A horse was bought for $175. At what price must he be sold to gain 12%?

8. A merchant bought apples at $1.20 a barrel and sold them at a gain of 25%. Find the selling price. How many barrels did he sell, if he received all together $187.50?

9. A person gave $1500 for a piece of land, and sold it at a gain of 20%. Find the selling price.

10. A man built a house for $3500 and rented it for $350 a year. For what per cent of its value did he rent it?

11. A quantity of goods was sold at a gain of 12½%. If the gain was $34, what was the cost?

12. When the cost is $8000, and the selling price $7400, what is the rate of the loss?

13. A boy sold a sled for $1.40, and by so doing lost 12½%. What did the sled cost?

14. Find the interest on $224.38 for 2 yr. 9 mo. 21 d. at 7%.

15. A man's salary is $2500 a year. He spends 30% for board, 12½% for clothes, 20% for other expenses, and saves the rest. How much does he save?

16. Find the interest on $716 for 1 yr. 5 mo. 12 d. at 5%.

17. An agent sold a house for $8350. He kept 5% to pay for his services. How much commission did he keep?

1. A man paid $105 for a carriage and $\frac{5}{7}$ as much for a sleigh. How much did both cost?

2. $\frac{6}{7}$ of 84 are how many times $\frac{3}{4}$ of 24?

3. If $5\frac{1}{2}$ lb. of sugar cost 44¢, how much will $2\frac{1}{2}$ lb. cost?

4. Reduce $\frac{1}{2}$, $\frac{2}{3}$, and $\frac{3}{5}$ to a common denominator.

5. Reduce $\frac{28}{40}$ and $\frac{35}{60}$ to their lowest terms.

6. Dick gave $\frac{2}{3}$ of his money for peanuts and $\frac{1}{3}$ for candy. What part of his money did he spend?

7. $\frac{1}{3}$ of a number increased by $\frac{1}{5}$ of it is 32. What is the number?

8. A man had 6 times $$6\frac{1}{6}$, and needed $4 more to buy a cow. Find the cost of the cow.

9. 4 times $2\frac{1}{3}$ miles is $\frac{1}{3}$ of the distance between two cities. How far apart are the cities?

10. If 4 men can do a piece of work in 3 days, in how many days can they do a piece of work 6 times as large?

11. What per cent of a yard is 2 ft.?

12. If $\frac{6}{7}$ of a yard of cloth cost 30 cents, how much will $\frac{3}{5}$ of a yard cost?

13. If 3 bags of meal cost $$3\frac{3}{4}$, how many bags can I buy for $2.50?

14. Two travelers start at the same time toward each other from cities 60 miles apart. A travels 7 miles an hour and B 8 miles. In how many hours will they meet? How far will each have traveled?

15. A and B can do a piece of work in 5 days. A can do it alone in 10 days. In what time can B do it alone?

16. The circumference of a cylinder is 16 in. If it is 6 in. high, what is its convex surface?

17. The area of one end of a cylinder is 12 sq. in. If it is 10 in. high, how many cubic inches does it contain?

18. A rectangular prism contains 72 cu. in. It is 6 in. long and 4 in. wide. How thick is it?

1. A Minnesota farmer raised 420 acres of wheat last year, which yielded 15 bu. of wheat per acre. How many bushels did he raise?

2. His expenses an acre for raising and harvesting his wheat were as follows: Ploughing 80¢, seed wheat (1½ bushels) @ 90¢, sowing 70¢, harvesting $1.80, marketing $1.40. Find the total expenses for the field.

3. Find his total gain, if he sold his crop at 80¢ a bushel.

4. One of the Minneapolis flour mills makes 1200 barrels of flour a day. If it takes 4½ bu. of wheat for each barrel, how many bushels do they grind each day?

5. How long would the farm of 420 acres supply the mill with wheat for grinding? How many such farms would be necessary to keep the mill running constantly for 300 days?

6. A bushel of wheat weighs 60 pounds. How many pounds of wheat are ground to make 1 barrel (196 lb.) of flour?

7. Besides the flour the 4½ bu. of wheat produce 25 lb. of shorts, 47 lb. bran, and 2 lb. of waste. Find the total amount of flour, shorts, and bran produced from the wheat on the above farm.

8. The milling company sold the bran at $14 a ton, the shorts at $16 a ton, and the flour at $4.50 a barrel. Find the total receipts for a week.

9. If the company paid $.90 a bushel for the wheat, and $450 a week for expenses, find their total gain for the week.

10. At the same gain a week find the total gain to the milling company for 1 year of 52 weeks.

11. Compare the annual profit of the farmer who raised 420 acres of wheat with that of the mill company. Compare also the amount of wheat handled by the farmer and by the mill company.

12. The 7 flour mills in Minneapolis produce daily 85,673 barrels of flour. Find the number of bushels of wheat used annually in these flour mills.

1. The cost of running a revenue cutter for one year was as follows: Salaries, $14,492.08; provisions, $1,913.77; coal, $6,446.80; repairs, $1,608.54; other expenses, $2,038.42. Find the total cost.

2. If this cutter used 246 tons of coal in 2 mo., how many tons did she use in a year? What price was paid a ton?

3. If the cutter cruised during the year 11,244 miles, what was the average number of miles a month?

4. Divide the total cost of running the cutter by the number of miles sailed. Find to the nearest dollar the cost for each mile.

5. Mr. S. has 62½ acres of land in tobacco in the Philippines. He set out 4000 plants to the acre. If each plant produced 20 leaves, how many bales of 4000 leaves each did he raise?

6. How many pounds did he raise if each bale weighed 21 pounds?

7. He sold 17,600 lb. @ 16¢, and 8360 lb. @ 21¢. What did he receive for his tobacco?

8. Mr. S. has also a sugar plantation, which contains 30 acres. If it yields 600 lb. to the acre, how many tons of sugar will the plantation yield?

9. If he sold his crop at $2.10 for every hundred pounds, how much did he receive?

10. Mr. S.'s expenses were as follows: 4 sacks of rice @ $2, 8 workmen @ $20 each, ploughing $30, hauling cane $15, feed of oxen $20, provisions $50, repairs $100, grinding cane $176. Find the total expenses.

11. How much less did he receive for his sugar than his total expenses amounted to?

12. Mr. S. has also a coconut grove of 7½ acres. There are 180 trees on each acre and an average of 90 coconuts on each tree. How many coconuts does the grove produce?

13. The coconuts sell on the tree at 55¢ a hundred. How much will Mr. S. receive from his coconut grove?

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